Dr. VATSYAYAN

Experimental Psychology

MADE EASY

[IN QUESTIONS & ANSWERS]

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PREFACE

This book solves degree examination questions of Bombay, *Calcutta, Madras, Punjab, Karnatak, Gujrat, Baroda, Mysore*, Poona, Kerala and other Indian Universities. The reader will find the following characteristics in this book:

* Subject matter of Ist division standard on every topic.
* Simple, plain and lucid language
* Quotations from reputed authors and scholars.
* Points in different type to facilitate revision.
* Every point in a separate paragraph.
* Covering the syllabi of all the Indian Universities and solving latest questions of the above mentioned Universities.

However, suggestions for improvements will be gratefully acknowledged.

—Vatsyayan

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Experimental Psychology : Nature, Scope, Status & Aims

Q. 1. What is experimental psychology ? Discuss its nature and scope

What is Experimental Psychology ?

Experimental psychology is that branch of psychology in which behaviour is studied though experimental method. Psychology is the science of behaviour. Behaviour includes inner experiences and overt activities The behaviour is studied in relation with the environment, part of which is controlled and part uncontrolled. Experimental psychology studies behaviour in controlled environment. Some aspects of behaviour and environment cannot be controlled Those, therefore, fall outside the scope of experimental psychology. Thus the scope of experimental psychology is extended to include all those aspects of behaviour which are subject to control. Experiment is controlled observation. Experimental psychology uses controlled observation

Nature of Experimental Psychology

As in clear from the above discussion, experimental psychology is a science Its nature is scientific In order to understand its nature more elaborately, let us understand what is science Experimental psychology is veridical It discovers the cause-and-effect relationship between the various phenomena On the basis of this discovery it predicts the future course in the various spheres of life. Experimental psychology as a science uses scientific methods. It very widely utilities the experimental method which is as much scientific as any other method in the strict sense of the term. It is factual because it depends on the facts The experimenter observes behaviour with an objective attitude, notes it, classifies and compares it and finally finds out general principles based on common factors. He does not pass a judgement on behav but only discovers its general principles. These principles of

tal psychology are universal if the circumstances do not change. They can be verified by any one at any time and at any place. On the basis of these principles the psychologist can predict the future course of human beings and groups. Thus experimental psychology is a positive science.

What is Science ?

Experimental psychology is a positive science. Before discussing the claims of experimental psychology to be called an exact science it is necessary to find out the meaning of the term science itself. Science is a systematic study of a limited field of experience. Thus a study can be called a science only when it has a limited field to study and a systematic method to use. It is however not the subject matter of a study that makes it a science, but its method. It is the method of science which distinguishes it from art and philosophy. Thus to understand science, it is relevant to analyse the various necessary steps in the scientific method.

Steps in scientific method

Scientific method requires much creative imagination, objectivity, patience and hard labour. It requires a scientific attitude or spirit in study. The following are the main steps in a scientific method—

(1) **Observation**—The first step in a scientific method is to observe the object of study closely and carefully. This observation requires various types of apparatus and instruments. These apparatus and instruments must be correct and exact.

(2) **Recording**—Another step in the scientific method is the recording of whatever is observed. This requires detached objectivity.

(3) **Classification**—After the data are gathered the scientist classifies it according to facts. As Karl Pearson writes, "The classification of facts, the recognition of their sequence and relative significance is the function of science."* The classification is done in such a way that a certain relation and pattern may be observed in the scattered data. Thus by classification the data are organised on a particular pattern.

(4) **Generalisation**—The fourth step in the scientific method is generalisation. By generalisation, scientific laws are discovered from the classified data,

*Karl Pearson, *The Grammar of Science*, p. 6.

(5) *Verification*—*The last and yet the most important step* in the scientific method is the verification of the laws that have been discovered. Scientific facts are veridical. They can be verified by any one under suitable conditions.

Essentials of Science

From the discussion of the steps in the scientific method as given above, it is clear that a science must have the following essentials—

(1) **Scientific Method**—It goes without saying that no study can be called a science without having a scientific method.

(2) **Factuality**—Science is factual. The scientist studies the facts with an objective attitude.

(3) **Universality**—Scientific principles are universal. They are found true in all times and in all climes.

(4) **Veracity**—Scientific principles are veridical. They are subject to verification and are verified through scientific methods.

(5) **Discovery of Cause effect Relationship**—Science finds out cause-effect relationships in the subject nature of its study and discovers universal principles.

(6) **Predictability**—On the basis of these cause-effect relationships, the scientist predicts the future course in various phenomena and these predictions come true because they are based on universal factual principles.

Experimental Psychology is a Science

After elaborately discussing the nature of science, the claim of experimental psychology to be called a science, can be easily examined. It will be found in sequence that experimental psychology has all the essential characteristics of a science as given above. The main points in this connection are as follows—

(1) **Experimental Psychology Uses Scientific Methods**—Almost all the methods of psychology are more or less scientific in their nature. Of these the experimental method is the most exact. It is no less scientific than any other method, used in other sciences. Experimental psychology widely uses this method in all its branches. In the experimental method the dependent and independent variables are distinguished, the dependent variables controlled and the effect of the independent variables observed. Thus in the experiment, the psychologist observes a certain phenomenon in strictly controlled situations. He also uses various types of instruments, e. g., *chronoscope, a highly sensitive clock, used to determine*

the interval time down to the thousandth part of a second in reaction experiments. The psychological laboratories are continuously *developing* and *new* and more *exact instruments* are *being* constantly put to use. With these instruments the psychologist observes the phenomenon, notes it, compares and classifies it and discovers various principles through generalisation. These general principles in experimental psychology are as much veridical as a science demands. It should be noted here that all other methods used in psychology are not as exact as the experimental method, but more and more efforts are being made to secure as much exactness possible. Whatever difference of opinion may there be among the psychologists regarding the merits and de-merits of a particular method, all agree that the methods utilised in psychology must be scientific.

(2) **Experimental Psychology is Factual**—Psychology studies the facts of behaviour. The psychologist is detached and objective in his observations and experiments. The proper field of psychology is not values but facts.

(3) **The Laws of Experimental Psychology are Universal**—The laws of experimental psychology have been found to be correct in every time and place, under the same conditions. The general principles of experimental psychology are universal, whatever differences there may be in the psychology of different individuals, e.g., the psychological fact that human beings and animals are emotionally disturbed by any impediment in the satisfaction of their impulses, is applicable everywhere.

(4) **The Laws of Experimental Psychology are Veridical**—Thus by verification and re-verification psychological principles have been found to be true everywhere. They can be verified by any one. To illustrate, it is a psychological fact that whereever there is some conflict, there are some frustrations behind it. This fact has been verified by the clinical psychologists. By discovering these frustrations, one can trace the causes of the particular conflict.

(5) **Experimental Psychology Discovers The Cause-effect Relationship in Human Behaviour**—Experimental psychology not anly observes behaviour, but also finds out cause-effect relationship in it, e.g., it has discovered why and in what circumstances a D L. is constant. These findings have been put to use and found correct. Thus experimental psychology discovers the 'how' of behaviour together with its 'what'.

(6) **Experimental Psychology Predicts Human Behaviour**—By discovering the cause-effect relationship, experimental psychology also predicts human behaviour and these predictions are generally correct. Thus in the modern progressive countries, appointments to different Government posts are made by relying on the predictions made on the basis of psychological tests. On the basis of these psychological tests, it is predicted that such and such person will be a good soldier and so and so a good administrator; and generally this proves true in actual experience.

Scope of Experimental Psychology

The history of psychology has witnessed ever widening scope of its field. Psychology today does not only study the animal behaviour, but it also studies the behaviour of man in all the stages of his development. Not only does it study different types of behaviour, but it also compares it and finds out general principles useful in the understanding as well as the control of behaviour. In brief, where there is behaviour, one finds scope of psychology.

The most important method of contemporary psychology is the experimental method and one finds it today particularly used in a growing branch of psychology, known as experimental psychology This is one of the most valuable branches of psychology since it uses strictly scientific methods in its study Experimental psychology studies external behaviour as well as the internal processes of the different stages of human development as also of animals *Only those phenomena fall outside its field* which cannot be studied in controlled situations. But the scope of experimental psychology is gradually widening with the invention of new tools and instruments for experiments.

Q 2 Describe the set up of a typical psychological experiment *indicating the functions of controls in it* *(Baroda 1965)*

Describe the different steps in performing a psychological experiment Illustrate your answer *(Bombay 1965)*

Clearly distinguish between independent and dependent variables and explain what is experimental control of variables *(Poona 1963)*

Explain the significance of independent and dependent variables and the parameters in experimental method

How is the necessary control of varibles effected in an experiment ? Illustrate by means of an example *(Nagpur 1967)*

Value of Experimental method :

Psychology is the positive science of behaviour. Science is a method. It is distinguished from philosophy on the basis of methodological difference. Science is the study of any object by scientific method. Hence if psychology is to be called a science, it should use scientific methods, *e.g.*, introspection, case history and observation etc. But experimental method is the most important method in the study of psychology. It is this method which has the credit of bringing psychology to the level of an exact science. Hence modern psychology places greatest emphasis on experimental method.

What is Experimental Method :

According to Garret experiment is a question asked systematically. Thus in experiment, the experimenter has a problem before him. He experiments to find out the answer to this problem. The clarity of the answer depends upon the clarity of the question. The question is based on a hypothesis. This hypothesis is proved or disproved by the experiment, *e.g.*, suppose that while studying or teaching some one thinks that motivation has its role in study. This is merely a hypothesis. To examine it, it is placed in the form of a question—does motivation effect study ? To get an answer to this question, it requires psychological experiments. Suppose by the experiments one arrives at the result that motivation is useful in the study : this proves the hypothesis. Now another question might be raised as to how far motivation helps in study ? This question will lead to further experiments in this line. In this way various types of enquiries can be made through the method of experiment *e.g.*, experiment regarding the effect of motivation on study. Similarly, the effect of smoking on study, of family environment on the child, the effect of intelligence and practice in learning etc., may be put in the form of the questions and experiments can be performed to get answers to them. In the experimental method, the observation is held in certain predetermined conditions. Thus experiment is a controlled observation. It is the observation of the behaviour or activity in fixed circumstances. The characteristic of this observation is that it can be repeated in different places and times without difference in results.

Steps in Experiment :

There are the following steps in a typical experiment :

(1) **Raising a problem :** The first step in an experiment is the raising of the problem *e.g.*, it is said that smoking is harmful to the students. On the other hand some say that it helps in concentration. Those who are neither for nor against smoking may say it is not smoking but the personality of the student which is relevant to his results in examinations. This discussion creates a problem about the effect of smoking on physical or mental capacity. This problem may lead to further experiments.

(2) **Formulation of a hypothesis :** The second step in expeimental method is the formulation of a hypothesis In the example of smoking the problem of its effect on physical and mental capacity can be put in the form of a hypothesis. This hypothesis will be like this "smoking is harmful for physical and mental capacity". Now this hypothesis will be tested by experiments.

(3) **To distinguish independent variable and dependent variable :** *The third step in experimental method is the distinction* between independent variables and dependent variables In the example of smoking, the physical and mental capacity will be the dependent variables, since they will be fixed in experiment. Smoking will be an independent variable since the aim of the experiment is to find out the effect of its presence and absence

(4) **Controlling the environment or situation .** The fourth and the most important step in the experimental method is controlling the environment or situation There are several difficulties in the above mentioned experiment on smoking. It is just possible that the subiect may try to prove that smoking has no effect on physical or mental capacities But to neutralise these possibilities the experimental situation is controlled. In the experiment on smoking, the eyes of the subject were closed by bandage Two exactly similar holders were used One of these holders had an electric wire through which the subject might inhale the warm air, while the other holder had a common cigarette. In all the sessions of the experiment all types of sounds, related with smoking were made, *e g* , the rubbing of the match etc. At the end of the experiment there were sticks and ashes lying round about, so that the subject might think that he really smoked The subject cannot touch cigarette at any time The experimenter himself puts and takes away the holders from his mouth In the sessions, when cigarette was not given to the subject, the experimenter him-

self smoked. To stop the signs received by the smoking sequence of giving and taking away the holders, the sessions of smoking and not smoking were kept irregular. These special arrangements in the case of experiment on smoking are necessary in all types of experiments. The arrangements of control differ according to the nature of experiments. In the case of man some special types of controls are necessary so that the subject may not know the principles of the experiment, since it is feared that this might make difference in his mental attitude. But in the case of experiments on animals this difficulty is not there. So there are different types of controls in the experiments on animals, *e g.*, Pavlov, in his experiment on conditioned reflex in the dog made special arrangement for the flow of saliva and to gather it out side dog's mouth.

(5) **Analysis of the result :** The fifth important step in the experimental method is the analysis of the results. Generally, the subjects of the experiment are divided into two groups—one controlled and another experimental. In the experiment on smoking every subject was also his controlled subject. All smoked half times and in the remaining half they inhaled warm air. The experimental group is often called independent variable, since the experimenter can stop it or modify it. In the experiment on smoking, cigarette is an independent variable and the results of its presence have been compared with the results of its absence For the analysis of the results of the experiment, statistical technique is used.

(6) **Verification of the hypothesis by the result of the experiment :** The sixth step in experiment is the verification of the hypothesis by the result of the experiment. The result of the experiment exhibits whether the hypothesis was right or wrong. In the experiment on smoking, it was found by the comparison of the sessions of smoking and non-smoking that there was very little difference in the results. Smoking increased heart-beat and the trembling of the hand. This effect was observed more in non-smokers than the smoker subject. No influence was observed on mental capacities known by mental tests. After 18 days of smoking it was concluded that it had very insignificant effect. This result disproved the hypothesis.

Limits of Experimental Method :

Like other methods, experimental method has also its own limitations. The following are the most important limitations of experimental method :

(1) Artificial situation of Laboratory : Artificial situation of laboratory is a characteristic of experimental method as well as its limitation. In the experimental method the experimenter leaves some variables. But it is very difficult to ascertain all the variables working in a particular situation, *e.g* , in the attainment of scholarship, the hours of work, the hours of extra-curricular activity, anxiety for future, interest in the social work, motivation for social work, hours of study etc., were controlled and the time given for student's activities was increased and decreased. The result by the increase and decrease of the hours of study shows its effect on scholarship But it is possible that the variables, controlled in this experiment may not include all those which effect the attainment of schoalrship. As a matter of fact it is very difficult to ascertain all the factors affecting the attainment of scholarship in a man and the result is that the effect of some of the factors might be alluded to some other.

(2) Difficulty in the control of the attitude of the subject : Another limitation in the experimental method is the difficulty in the control of the attitude of the subject. In experiments on men it is often very necessary to control their attitudes, since if the subject is opposed to the experiment or careless towards it, he might give wrong answers or keep silent But it is not always easy to control the attitudes of the subjects specially when they are children or students This makes the result of the experiment unreliable.

(3) Difficulty of securing the co-operation of the subject : Another difficulty in experimental method is the difficulty of securing the co-operation of th. subject Experimental method is impossible without the co-operation of the subject, but the co-operation is not always easily forth-coming It is possible that the subject may show himself fatigued or not fatigued according to his attitude or give false replies This difficulty makes experimental method unreliable

(4) Limited Field : The last but not least, important limitation of the experimental method is the limitation of its field. In several matters it cannot be applied at all, *e g* , if one has to know the effect of bad environment on child's development it is not possible to place some children in bad environment and to wait for the results. Again, in the case of the mental states, like love etc., it is neither possible to control them nor to create them in

the laboratory. These and many other phenomena can be studied only through observation or introspection etc.

Inspite of above limitations of the experimental method, it is undoubtedly the most important and valuable method in psychology. It is by this method that the psychologist arrives at the most exact conclusions about behaviour. But experimental method is limited to only those aspects of human behaviour, where one may hope to arrive at exact conclusions. On the other hand, some aspects of human behaviour are so changeable and complex that one should be satisfied with their observation and arrive at some workable conclusions. The field of experimental method however, is gradually being widened with the advent of new inventions, regarding tools and instruments. If observation and introspection methods have widened the field of psychology and made it more useful in daily life, it is experimental method which has secured a respectable place for psychology among the sciences. In the world outside the limits of laboratory, man will always learn by experience and oservation but it is on the experimental method alone that the future of psychology as a science depends.

Control in Experimental Method :

In an expriment, the subject is studied in controlled situations. The experimenter divides different factors in the experiment into dependent and independent variables and controls the former to watch the influence of the latter. Without such a control, the result of the experiment can never be dependable, *e.g.*, in the experiment to determine the effect of smoking on study, the constancy of the age of the subjects, their intelligence, work at school etc., are necessary because all these factor [illegible] nce the study. If these do not remain the same or constant [illegible] nce by the influ [illegible] either of them may be mis-interpre [illegible] ence due [illegible] g or non-smoking. In ordin [illegible] ortance [illegible] ontrolled observation is not s [illegible]. Hen [illegible] conclu-

measure by certain factors, e.g., the age, intelligence, motive, intention, education and the physical and mental states such as hunger, fatigue etc. All these can influence the result of the experiments. Hence no definite conclusions can be drawn without controlling all these factors.

Thus every experiment has certain conditioning factors. In them, the general condition of the subject is very important. In the psychological experiment the attitude must be controlled. For example, if an experiment is being conducted with regard to learning, it is necessary that the subject should not be averse to learning since that will lead to the failure of the experiment. In such experiment the subjects are told that they should attend to such and such stimuli and leave such and such. Sometimes the subject is kept in illusion. He is told that a certain thing is being examined, while actually it is something else which is under examination, e g., in order to determine the influence of a certain medicine, sometimes the water and sometimes the medicine is injected. In experiments on animals, the attitude of the subject need not be controlled. But in experiments on human beings, specially adults, it is necessary, to control the attitudes of the subjects.

Side by side with the internal attitude, the external stimuli should also be controlled Stimuli include all those internal and external factors which have some effect on the subject to be studied, e.g., light, sound, touch, temperature, smell etc., are external stimuli and nervous excitements are the internal stimuli. Both these types of stimuli affect the subject. Hence they are controlled. The external stimuli are controlled with the help of various types of rooms and apparatus The internal stimuli are controlled by administering certain medicines or particular type of food or by keeping the subject hungry etc

In certain experiments, the heredity should also be controlled, e g., if the psychologist has to determine the effect of training and maturity on the development of the child, he should take two types of subjects i e trained and untrained Along with this both these subjects should also be the same Similarity of heredity is found only in identical twins Hence in such experiments the psychologist should take identical twins Now one of these should be trained and the other untrained The comparison of the development of both these will exhibit the influence of training on development. Thus in the experiments on human beings, many

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measure by certain factors, e g., the age, intelligence, motive, intention, education and the physical and mental states such as hunger, fatigue etc. All these can influence the result of the experiments. Hence no definite conclusions can be drawn without controlling all these factors.

Thus every experiment has certain conditioning factors. In them, the general condition of the subject is very important. In the psychological experiment the attitude must be controlled. For example, if an experiment is being conducted with regard to learning, it is necessary that the subject should not be averse to learning since that will lead to the failure of the experiment. In such experiment the subjects are told that they should attend to such and such stimuli and leave such and such. Sometimes the subject is kept in illusion. He is told that a certain thing is being examined, while actually it is something else which is under examination, e g., in order to determine the influence of a certain medicine, sometimes the water and sometimes the medicine is injected. In experiments on animals, the attitude of the subject need not be controlled. But in experiments on human beings, specially adults, it is necessary, to control the attitudes of the subjects

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factors are to be controlled. In the experiments on animals, sometimes some external or internal organ has to be removed through operation, e.g., in order to determine the influence of a certain endocrine gland the behaviour of the animal is noted, the endocrine gland is removed and the behaviour is again noted. Now a comparison of the behaviour with and without the paticular endocrine gland will give the influence of that gland on behaviour.

Dependent and Independent Variable :

As has already been pointed out, the different factors in an experiment are divided into independent and dependent variables. Independent variables are stimuli or particular state of the subject which can be changed as desired. Often the independent variable is one because the experimenter has to see the effect of every factor separately. But if the effect is due to two factors, which are not separated from each other, it will be difficult to determine how much influence is exercised by each of them. In the statistical method, there can be more than one independent variable because statistical analysis separates the influence of each factor.

Dependent variable, as is clear from its name, depends on the independent variable. The experimenter keeps all the factors of his experiment constant and changes some one factor. This change results in a certain effect in the subject. These factors are the dependent variables. These include the external behaviour of the subject, *e. g.* speaking, hearing, laughing, weeping etc. as well as internal processes. The internal processes are determined with the help of certain instruments.

The analysis of various factors of control in an experiment, as given above clearly shows that the method of experiment very much depends on the control of the various factors in the particular experiment.

Q. 3. Discuss the chief contribution of Wundt to the growth of Experimental Psychology. *(Agra 1963)*

In the development of modern psychology in Germany Wundt has played a very significant role. Wundt established the first psychological laboratory of the world and encouraged psychological experiments. He himself performed many experiments and it deserves special mention that all his experiments were of a scientific nature.

Early life and Education

Wilhelm Wundt was born in a place called Neckaran in the

year 1832. His early education was under the guidance of a priest. Later on he studied Medicine at the Tubingen University. After this he went to Heidelberg University where he studied Physiology. In 1856 he went away to Berlin and further studied Physiology. Here he made a detailed and experimental study of Physiology under the guidance of Muller. At that time Muller was famous as the greatest physiologist. Wundt learnt a lot from Muller.

In 1857, Wundt agreed to deliver lectures in the Hiedelburg University and remained on this post for 7 years During this period he wrote a book on Physiology. In 1864 he became associate professor. Helmholtz did not encourage Wundt in conducting experiments in Physiology as Wundt's mathematical knowledge was not sufficient for such experiments. In 1874 Wundt accepted the post of professor of philosophy in the Leipzig University Here he performed physiological experiments and established the world's first physiological laboratory. Thus his fame spread far and wide and students from different countries started coming to him. The Americans, Cattell and Hall, were among his first students.

Wundt wrote many psychological articles and books. In 1863 one of his articles the subject of which was sense perception was published. In this he threw light on the scientific facts related to sensations. The most famous of his books named *Outlines of Physiological Psychology* was published in 1874. This book was three parts and contained nearly 2400 pages Wundt did considerable labour on this book and this book became so popular that by 1911 six editions of it had come out

In addition Wundt also wrote some text books for the teaching of psychology. These books were most useful for the students of psychology. In fact, Wundt remained busy throughout his life in continuous study and writing He wrote another book on Folk psychology which had ten parts A special feature of this book was that he started writing this when he was 70 years old. Wundt had an interest in experimental psychology And this is clearly indicated in all his works

CONTRIBUTIONS TO PSYCHOLOGY

To clarify the nature of psychology, Wundt organised its various subjects into a systematic form and at the same time made these subjects clear. In other words he made psychology systematic and in this way made it easy for the students to study psychology.

Wundt analysed and explained such mental processes as sensation, perception and concepts. The basis of this study was experimental. He explained the part that was played by the nervous system and sense organs in the development of sensation. He accepted sensation and feeling to be a necessary element of the mind and described intensity, quality and duration in defining sensation He performed different psycho-physical experiments concerned with intensity in sensation and defined them on this basis. While defining it, he threw light on the simple form of sensation. He made direct perception the basis of extent and duration.

Feelings

According to Wundt there are three dimensions of feeling. First dimension of feeling was pleasant or unpleasant. In other words on one end of the dimension of feeling, pleasant feeling is found and on the other unpleasant feeling. In this way both ends are completely different from each other. On the one end of the second dimension is peace and on the other opposite to it exists excitement. Similarly, in the third dimension rest and tension are found.

Wundt discovered by experiments that during pleasant feeling there is also a feeling of peace and rest. On the contrary, unpleasant feeling also has excitement and tension in it. Similarly, aiming at the arousal of feeling, three out of the six kinds of mental conditions should necessarily exist. This theory of Wundt is famous as the theory of tri-dimensional feeling.

Ideas

According to Wundt a concept is related to direct perception. He said about the nature of perception that it was the combined form of feeling and memories. Ideas and concepts emerge from direct perception.

Wundt has classified ideas and concepts on the basis of their qualities. According to this classification there are three kinds of ideas :

1. Intensive Ideas
2. Space Ideas
3. Time Ideas

Wundt said about the intensive idea that its development occurs when the ideas are associated on the basis of consonance and resistance. Intensive ideas are related to those sounds and thoughts in

which similarity and dissonance are found. Intensity in Ideas is due to the unity in their form Opposite ideas cannot combine to *become intense.*

Wundt has written about space ideas that these are ideas which are connected with space. Similarly, time ideas are those ideas which *are related to time. As the individual goes on gaining experience on* the basis of physiological activities, time and space ideas go on increasing at the same rate The amount of time consumed by a work is known by the time idea and similarly distance from one place to another is perceived by space idea.

According to Wundt the evaluation of feeling and emotion is related to the nervous system. In other words some physiological *change takes place in the creation of feeling and emotion.* When feeling occurs in a person then some peculiar reactions occur in his body. Feeling is the cause which impels man to action and movement in some direction

Apperception

Wundt said about apperception that it was related to the upper portion or the brain. The action of apperception occurs by the combination of nerves. Association has an important role in the development of apperception. The awareness of association goes to the brain through the medium of the nerves, where perception evolves. The sensations of the individual acquire meaning on the basis of association. In the action of remembering there is the con*tribution of both apperception and association Ideas and concepts* develop on the basis of association and the action of remembering takes place on this basis When any special fact or concept needs to be remembered, then both association and apperception are helpful in its selection. It will be appropriate to say that if there is no co-operation of association and apperception in the action of remembering the many thoughts will come in a single memory and it will be hard to decide as to which idea is needed

It is clear that Wundt studied mental processes on a physiological basis but he also made it clear that the actions of mind and body do not depend upon each other to such an extent that there cannot be any consideration of them separately Wundt has accepted that mind and body are distinct but still they are intimately associated with each other. *In other words* mind and body are parallel to each other. But Wundt has not clarified why they have this close *relation between them*

Wundt analysed and explained such mental processes as sensation, perception and concepts. The basis of this study was experimental. He explained the part that was played by the nervous system and sense organs in the development of sensation. He accepted sensation and feeling to be a necessary element of the mind and described *intensity*, quality and duration in defining sensation He performed different psycho-physical experiments concerned with intensity in sensation and defined them on this basis. While defining it, he threw light on the simple form of sensation. He made direct perception the basis of extent and duration.

Feelings

According to Wundt there are three dimensions of feeling. First dimension of feeling was pleasant or unpleasant. In other words on one end of the dimension of feeling, pleasant feeling is found and on the other unpleasant feeling. In this way both ends are completely different from each other. On the one end of the second dimension is peace and on the other opposite to it exists excitement. Similarly, in the third dimension rest and tension are found.

Wundt discovered by experiments that during pleasant feeling there is also a feeling of peace and rest. On the contrary, unpleasant feeling also has excitement and tension in it. Similarly, aiming at the arousal of feeling, three out of the six kinds of mental conditions should necessarily exist. This theory of Wundt is famous as the theory of tri-dimensional feeling.

Ideas

According to Wundt a concept is related to direct perception. He said about the nature of perception that it was the combined form of feeling and memories. Ideas and concepts emerge from direct perception.

Wundt has classified ideas and concepts on the basis of their qualities. According to this classification there are three kinds of ideas :

1. Intensive Ideas
2. Space Ideas
3. Time Ideas

Wundt said about the intensive idea that its development occurs when the ideas are associated on the basis of consonance and resistance. *Intensive ideas* are related to those sounds and thoughts in

which similarity and dissonance are found. Intensity in Ideas is due to the unity in their form. Opposite ideas cannot combine to become intense.

Wundt has written about space ideas that these are ideas which are connected with space. Similarly, time ideas are those ideas which are related to time. As the individual goes on gaining experience on the basis of physiological activities, time and space ideas go on increasing at the same rate The amount of time consumed by a work is known by the time idea and similarly distance from one place to another is perceived by space idea.

According to Wundt the evaluation of feeling and emotion is related to the nervous system. In other words some physiological change takes place in the creation of feeling and emotion When feeling occurs in a person then some peculiar reactions occur in his body. Feeling is the cause which impels man to action and movement in some direction.

Apperception

Wundt said about apperception that it was related to the upper portion or the brain The action of apperception occurs by the combination of nerves. Association has an important role in the development of apperception The awareness of association goes to the brain through the medium of the nerves, where perception evolves The sensations of the individual acquire meaning on the basis of association. In the action of remembering there is the contribution of both apperception and association Ideas and concepts develop on the basis of association and the action of remembering takes place on this basis When any special fact or concept needs to be remembered, then both association and apperception are helpful in its selection. It will be appropriate to say that if there is no co-operation of association and apperception in the action of remembering the many thoughts will come in a single memory and it will [illegible] hard to decide as to which idea is needed

It is clear that Wundt studied mental processes on a phys[illegible] logical basis but he also made it clear that the actions of [illegible] body do not depend upon each other to such an extent that [illegible] not be any consideration of them separately Wundt has [illegible] that mind and body are distinct but still they are [illegible] ted with each other In other words mind and [illegible] each other. But Wundt has not clarified why they [illegible] relation between them

In psychology too Wundt has laid stress on experimental psychology. For his experiments he chose only those subjects on which much information was not available. In addition to visual and auditory sensations, Wundt is also credited with the experimental s udy of other sense organs. He also experimented to determine the time for physical reactions. He also found out the time taken for the related reaction when the appropriate stimulus occurs. In this way psycho-physics was strengthened by the experiments of Wundt. He also studied association and apperception.

Wundt's greatest contribution to psychology lies in the method of the study of psychology. In fact Wundt started experimental psychology. Even before Wundt psychologists had written from time to time on the scientific study of psychology but it was Wundt who applied this in practice. He found out many facts by experiments in the laboratory. It must also be remembered that Wundt established the world's first psychological laboratory.

Q. 4. Write a note on the contribution of Herman Von Helmholtz in Experimental Psychology.

(Agra 1963, 1960, 1958; Baroda 1959)

After Wundt, the name of Helmholtz is most notable in the development of experimental psychology. As is obvious from his name, Helmholtz was a German, born in 1821 at Potsdam, a place near Berlin. His father was a teacher of linguistics and philosophy and Helmhotz's early education was under his guidance. But he was never a brilliant student. May be the cause for this was that from childhood his health was not satisfactory. Thus he could not lead a more active life though he had great interest in games.

Helmholtz was interested in science, especially in physics. Hence he started studying physics and very soon acquired considerable knowledge in it. In those days it was not sufficient to study science for livelihood. Hence Helmholtz also had to study medicine. At the age of 21 he published an article on medicine in which he said that the cells of gangalia were attached one by one to different veins. Before this there had not been any study on this subject. Hence this subject and fact was welcomed in the medical field. From here, Helmholtz's career started.

Helmholtz was enlisted in the army He was appointed as a surgeon. During his stay there he performed many psychological experiments and made intense study of energy. He also wrote an essay on the conservation of energy. In this essay he described the

importance of energy and that how necessary was its conservation. Psychologists had not yet paid any attention to this subject.

Helmholtz was interested in experimental psychology. His most important work in psychology was the *Principles of Physiological Optics*. He wrote a book on physiological optics which had three parts separately published in 1856, 1860 and 1866 respectively. These three parts were on physiological optics but physics has been used as the basis in the first part, physiological dynamics in the second and psychology in the third.

1. *Young-Helmholtz Principle of Colour Vision*—Helmholtz conducted an experimental examination of Thomas Young's principle of colour vision and found it to be defective. He amended this principle, which came to be known as the Young-Helmholtz principle of colour vision Before we understand this principle we must know about Young's principle In brief, Young's principle was that in fundamental form there are three colour sensations. They are Red, Green and Violet respectively. In their different mixtures were seven colours. as Yellow is formed but mixing Red and Green, Orange from Violet while Red and Blue are formed by Green and Violet. The seventh colour is white light which is formed by the mixture of the three primary colour sensations Helmholtz amended this principle. According to him the three main colours are Red Green and Blue While defining these three colours, he conceived of three cones of retina which are known as R Con, G. Con, and B. Con. The nerves of these are related to the Red, Green and Blue colours When these cones are stimulated separately then the sensations of red, green and blue colours respectively occur When the cones of red and green colours are equally stimulated by the light waves then yellow colour is seen When the three cones are equally excited by the light waves then individuals have colourless sensation This is the theory of Helmholtz.

In criticism of this theory it can be said that there is no clear definition of colour-blindness in it. It has been seen by experiments that those persons who are blind to red and green colours can see yellow colour. It is not possible to explain this phenomenon by the principle of Helmholtz. Still the importance of Young-Helmholtz principle cannot be questioned Enough light has been thrown by it on physiological colour optics and the interest of other scientists has been directed towards this subject.

2. *Auditory Sensation*—Helmholtz also studied auditory sen-

sations and maintained that there are thousands of nerves in the inner membrane of the ears. Their number is between 18 and 24 thousand. The nerves of the membrane of the ear can be compared with any stringed musical instrument. By the agitation of one specific wire of an instrument a special kind of sound is produced. The same work is done by the nerves of the ear membrane. These also resonate sound into the ear.

This fact has also been criticized. It has been proved that the nerves of the ear membrane do not have the capacity to resonate sound.

3. *Unconscious Inference*—Helmholtz has said while defining unconscious that for direct knowledge an unconscious inference is most necessary. Every person indulges in unconscious inference, and this action is natural. It is often seen that when a person sees a colour then he forms an unconscious inference about the opposite colour.

In addition to it the development of unconscious inference depends on experience. By and by when experience increases in a person, his capacity for unconscious inference also improves. The action of unconscious inference is similar to conscious inference. But while unconsciously inferring, a person does not know that he is doing so.

4. *Direct knowledge*—Helmholtz has also defined direct knowledge. According to him direct knowledge is related with the stimulas and the specific sense organ. It is also related with the pre-conception of man and his unconscious inference. While defining the characteristics and qualities of things Helmholtz has written that they help in gaining direct knowledge. No person can change the quality or characteristic of an article. These are unchangeable.

In addition to this, Helmholtz also studied temperature and said that it can be measured. Helmholtz has accepted the relationship between psychology and human physiology and has defined mental processes on this basis. In fact Helmholtz contributed greatly to the development of experimental psychology and did much labour in this respect.

Q. 5. Write a note on the contribution of Cattel to Exprimental Psychology. *(Agra 1960, 1963)*

In American psychology the name of J. McKeen Cattel is most important. Cattel was born in Estan in 1860. He had his early

education at the Lofact College. His father was also the president there. Later Cattel went to Europe for higher education. For three years (1883–1886) he remained a student of Leipzig University where he came in contact with the famous German psychologist Wundt. Cattel learnt the experimental method of psychology from Wundt

From Germany Cattel went to Britain and took admission in Cambridge University. Here he had the honour of becoming a student of Galton. Later on he was appointed as a lecturer there. He established a psychological laboratory here. He returned to America 2 years later and was appointed as a lecturer of psychology at Columbus University. Here too he established a laboratory.

Till the first world war he worked in this post but during war he resigned from this job. Cattel was a believer in peace and hence opposed war. When he expressed his opposition against war then differences occured between him and the university officials and due to this he resigned From this it is clear that Cattel was a determined and fearless person. He strictly adhered to his principles.

A noteworthy thing about Cattel was that he remained a pupil of three pioneering psychologists of Europe, Britain and America—In Europe under Wundt, in Britain under Galton and in America under Stanley Hall While working with Wundt he obtained his doctorate. He studied experimental psychology and designed suitable apparatus for experiments. From Galton he learnt the use of statistics in psychology and here too he designed some apparatus

Contribution to Psychology

Cattel's field was experimental psychology. Hence in psychology he always stressed the experimental aspect. He did experiments concerning reaction and worked in the field of measurement of direct knowledge He used an apparatus called tachitoscope for this purpose He found out the fact on studying the direct knowledge of children that in the beginning it is unified but later on it can be analysed in categories It was learnt from his experiments that separate letters should not be used while teaching language to children but they should be taught complete words

Cattel designed many necessary mental tests to measure individual differences In fact he wanted to measure mental abilities. He lso wanted to know what mental ability lay at the root of the work done by man.

Hence Cattel experimented on individual differences. He also experimented on reaction time, association, direct knowledge and psycho-physics etc. He also used statistics in the experiments on reaction time. Thus conclusions relating to reaction time can be definitely found by this method. In 1887 he published a description of experiments concerning association and two years later published an essay on free association. Important suggestions on language teaching also resulted from Cattel's experiments related to reading. As has been written earlier Cattel studied direct knowledge of children and suggested about their language teaching that they should be taught not by letters but by complete words.

He published an essay in 1890 on individual differences. In this he emphasized the need for mental experiments to measure individual differences. It is noteworthy in this respect that Cattel used, for the first time the word Mental Test in psychology. In this essay Cattel described many mental experiments which are used every year to determine the mental level of college students. Cattel included the power of muscles, intensity of speed, pain, absorbing power, vision and visual intensity, weight discrimination, reaction time, memory etc. in his mental experiments. Since determination of mental level depends on measurement hence only those mental experiments should be chosen which can be easily measured.

In addition to mental experiments Cattel developed many new fields in psychology. He had the ability to organise. He published his writings from time to time in a magazine called *Psychological Review*. Cattel is also credited with arranging for the publication of *Psychological Monograph* and *Psychological Index*.

Cattel edited many reference books among which the famous books were "*Scientists of America*" and "*Leaders in Education.*" He also published a Directory of American scientists and scholars. In addition he published a monthly magazine concerning science.

In 1895 Cattel was elected President of an association called the American Association for the Advancement of Science. Later on in 1926 he became the Chairman of the Ninth International Psychological Congress. In 1931 he organised the American Psychological Corporation. The main aim of this organisation was to organise various psychological experiments and even today this organisation is doing useful and important work.

In the end, it can be said that Cattel has made important contributions to experimental psychology. He studied individual differ-

ences on an experimental basis and accepted the importance of mental tests in this subject He established psychological laboratories. He studied direct knowledge of children on the basis of experiments and presented important facts

Cattel was a good editor. He contributed to the development of psychology by editing many books and magazines. He had a great personality. His behaviour with his friends and pupils was very cordial and he was fearless and resolute in his principles. He fearlessly and openly criticised those whom he wanted to.

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2

Psycho-Physical Methods

Q. 6. What do you mean by Psychophysical Methods? Discuss its importance in experimental psychology. *(Gorakhpur 1962)*

Or

Describe 'Method of Limits' or 'Method of right and wrong cases' and give examples. *(Gorakhpur 1964)*

Or

Write short note on—'Psycho-physical Methods'. *(Gorakhpur 1961)*

Discuss with example, the method of average error in psycho-physical measurement. *(Nagpur 1968)*

Discuss the method of Average Error? *(Bombay 1965)*

Describe the procedure of the method of average error. Indicate the characteristic features of this method. *(Poona 1963)*

Among the methods used in experimental psychology, psycho-physical methods are the most quantitative methods. They are specially used in psycho-physics. The chief of these methods are given below :

(1) **Methods of Limits** :—This method has been specially used in studying sensory threshold. Different environments are controlled first of all in this method. After that the person experimented upon is made to sit in an easy position and a wooden screen is placed between the experimenter and the person experimented upon. Absolute threshold and differential threshold are found out through this method. Their methods are given below :

(a) **Measurement of absolute threshold**—To understand absolute threshold, we have to suppose that we want to know absolute threshold relating to cutaneous sensation. Now the person, experimented upon, is made to sit in a suitable position as described above and then the experimenter will instruct him like this—"Your skin will he touched at such a place with such a kind of thing. If you feel the touch, say 'Yes' and 'No' if you donot feel it". After issuing these instructions, the experimenter will touch the specified

part of the body with a specified thing which he may surely feel. Now he gradually goes on decreasing the force of stimulus to a degree where the stimulus is no more felt. After this stage is reached, the experiments are stopped. In this way, after experimenting *from increased to decreased stimulus, the experiment is* restarted with decreased stimulus which is again gradually increased unless it is clearly felt. Thus we get at two kinds of sensations—from increased to decreased and gradually from decreased to increased. In both the kinds of these stimuli, we reach such a transition point where a change of stimuli is clearly felt. This shows the average threshold of both the transition points In this way, absolute threshold is the average of the descending and ascending series. Both the kinds of series, descending and ascending, are taken so that the result of the experiment may be reliable and factual. The average *of the threshold of both the kinds* of chains shows the absolute threshold.

(b) **Differential threshold** :—Two kinds of stimuli are needed to find out differential threshold which is also known as D.L.—standard and variable stimuli In this also, descending and ascending chains are gone through In this the person experimented upon talks the difference between the two stimuli after comparing—variable and standard Weber widely employed this method in his experiments.

(2) **Method of right and wrong cases** .—The modern name of this method is Method of constant stimuli. In this, the number of mistakes due to habituation or expectation, is very small and therefore it has a greater scientificality Absolute threshold and differential threshold are known through this method) Their methods are given below

(a) **To find out absolute threshold** —For this, some fixed stimuli are repeatedly presented before the person experimented upon randomly and he has give judgement about them For example, suppose you find, with the help of aesthesiometer, the minimum distance between the two points, which provides sensation of both the points to the person under experiment Now you will instruct him like this, "A sensation will be given to your skin at such and such place, you will say 'one' when you feel one point and 'two' when you feel two points " Now, by giving some practical trials, the highest and the lowest limits of sensation are found out. When it is found out, the distance of the highest limit is reduced a little and the stimuli is aimlessly presented before the

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person experimented upon. Every time the skin of the person experimented upon is touched at two points with aesthesiometer. In reaction when the person experimented upon says 'two', it is regarded to be correct, but when he says 'one', it is incorrect. Now, the correct and incorrect reactions are enlisted and absolute threshold is found out with their help. Sensation of this absolute threshold is felt in 50 percent attempts of the person experimented upon.

(b) To find out differential threshold :—Like the method of limits, standard variable stimuli are presented before the person under experiment to find out differential threshold in the method of constant stimuli as well, and every time he is asked whether the variable stimulus is bigger than, smaller than or equal to the standard stimulus. Stimuli are repeated in an irregular form. The person under experiment is instructed, "Two lines at a time will be presented before you, you will look at them and tell which of them is bigger and which is smaller." Now in 75 percent attempts, the threshold declared as big will be regarded big and threshold declared as small, in the same number of attempts, will be regarded small. The differential threshold will be found out by dividing the total of the highest and the lowest threshold by two.

(3) Method of mean or average error :—Whereas in the method of limits as well as in the method of constant stimuli, the experimenter brings about a change in controlled stimulus, this change, in the method of mean error, depends on the subject. The subject, after his observation of the standard stimulus, gradually increases and decreases the variable stimulus. In this process, he sometimes over-estimates and sometimes under-estimates the standard stimulus. Due to this, the variable stimulus, instead of being equal to the standard stimulus, sometimes becomes bigger than and at other times smaller than the standard stimulus. The subject, after making different attempts, finds out the mean error by taking out the average of the errors of evaluation.) For example, suppose there is a standard line measuring 40 milimeter and the subject has to draw a line equal to it; its error, in different trials will be noted in the method given below.

Trial No.	Right side	Left side	Trial No.	Right side	Left side
1	41	42	6	43	37
2	42	38	7	37	39
3	44	36	8	39	41
4	38	44	9	42	43
5	36	41	10	41	42
	201	201		192	192

Average on the left side $= \frac{402}{10} = 40.2$ milimetre

Average on the right side $= \frac{384}{10} = 38.4$ milimetre.

Average of the total evaluation $\frac{40.2+38.4}{2} = 39.3$ milimetre.

∴ Mean Error $= 40 - 39.3 = 0.7$ milimetre.

It is clear from the above result that a line of 40 milimetre in length will. on 50% or more occasions, appear to the subject to be different from the line of 40+·7 milimetre. This has been found out through the method of mean error used in taking out threshold. Before beginning the above experiment, the subject will be instructed in this way, "Draw another simple line equal to the given simple line through your own presumption and donot use any scale in doing so." The subject will draw this line at one time to the right and at another time to the left of the standard line. When the number of trials in drawing lines to the right is equal to the number of trials in drawing lines to the left, space errors are escaped. In the same way, the subject is given stimulus at one time much greater than the standard stimulus and much less at another time in order to reduce the errors of habituation.

Errors of Psychophysical Methods

Although psycho-physical methods are considered to be very important methods in experimental psychology, yet they are not found to be all correct. The errors occur due to the difference between the actual measurement of the stimulus and its evaluation by the subject As a matter of fact, this very difference is the error, The main errors of the psycho physical method are given below.

(1) **Accidental errors** —Accidental errors, as is clear from their name, are those errors which occur due to chance or to some unknown reasons. The experimenter, the subject or any person inside the laboratory may cause such errors. For example, the experimenter's observation may be erroneous or they may be due to the experimenter's mental and physical condition being unfavourable for the experiment. Such errors are possible in all experiments. An attempt is therefore made to reduce them as far as possible or atleast their effects are traced so that they may be borne in mind at the time of evaluating the results of an experiment.

(2) **Constant errors**—Constant errors, as is clear from their name are those errors which occur constantly. These errors are such as cannot be avoided even if their causes are known. For example, out of the two equal stimuli, the subject takes one to be bigger or smaller than the other. The main forms of constant errors are given below :

(a) **Time errors**—When two stimuli, instead of being presented at one and the same time, are presented one after the other, it is natural for the subject to err in evaluating them. In the same way, time error occurs due to the difference of time in presenting two stimuli. For example, if a second line is presented a few seconds after the presentation of the first simple line, there is every possibility of an error on the part of the subject in evaluating it.

(b) **Space errors**—When two stimuli are presented, one on the right or the left side of the other, there is a possibility of an error in evaluating them. The error is called space error due to a change of space. To avoid this error, the changing stimulus is sometimes presented on the right side of the standard stimulus and sometimes on the left side, although it does not remove the error completely.

(c) **Variable errors**—Variable errors keep changing with the subject in particular and depend on the condition of the subject. For example, errors gradually decrease with the increase of habituation in evaluation. On the other hand, when the subject is tired of doing the same kind of work continuously for some time, it may also cause an error in evaluation. This effect of habituation and tiresomeness can be stopped to some extent by decreasing or increasing the working method, but it cannot be stopped completely because the alternating errors depend on the particular subject to a great extent. One subject becomes habituated in a short time and the other may take a long time. One may get tired very soon and the other may take some more time to get tired. A similar working method, therefore, cannot be decided in all cases.

Inspite of the above errors, the psycho-physical methods are scientific. As a matter of fact, it is through the knowledge of these errors that the experiment results can be scientifically decided. It is needless to say that the credit of placing experimental psychology in the position of pure science goes to the psychological methods.

Q. 7. What do you mean by a sample ? Discuss the techniques of drawing a sample from the population. (*Agra 1964, 1962*)

Investigation in statistics is done through census or sample. *In census, knowledge about all the units of the entire area is* obtained and no unit can be left out. Such a study is made on the basis of all the units. But in sampling technique, some units are picked up as samples out of the whole field of investigation and information about these very units is gathered for study. For example, the number of people in a city is 10,250 and their annual income is to be studied, information about the income of 10,250 persons will be gathered for study, whereas, in sampling, a study will be made by selecting 250 or 300 persons as a sample and by gathering details about their income. Since sampling saves time, labour and money, the results of this very technique are, therefore, applied to the entire area in most of the investigations. *It is,* therefore, necessary that the sample selected should be such as to *represent the whole population.*

Techniques of Sampling

The following are the main techniques of Sampling:

(1) Deliberate Sampling.

(2) Random Sampling

(3) Mixed Sampling

(1) Deliberate Sampling *:—In this technique, some units* from within the population are selected according to the desire of the investigator. He selects the units which, in his opinion, represent the whole population This technique of sampling is very simple, but it may include personal bias of the investigator. To reach a conclusion based on his own ideas, he can select such units as are suited to his own conclusion This technique is appropriate for such areas where all the units are nearly similar.

(2) **Random Sampling** —This technique of sampling is better than Deliberate sampling because the personal bias of the investigator does not work in this technique There is full probability of all units being included in sampling and the units for sampling are on the basis of chance or at random

The following techniques are employed in selecting Random Sampling.

(a) **Lottery method** .—In this method, lots of all the units of population are made and drawn by an impartial person or child.

(b) **By rotating the drum** .—In this, lots or tablets bearing the number of units are cast in a drum and rotated and the lots are then drawn one by one by some impartial person

(c) **By systematic arrangement** :—In this method, all the units are divided into numerical, geographical or caste gradation and sample units are selected on that basis.

Lottery method is the simplest of all the three methods given above and is mostly applied.

(3) **Mixed Sampling** :—In this method, the population is first divided into various parts according to its different specialities and after that the units are selected on the basis of Random sampling. In this way, this method includes both the methods, Deliberate Sampling and Random Sampling. This method is therefore called Mixed Sampling. This method is suitable where there are data of different qualities in population and which are not classified.

3

Measurement in Psychology : Classification, Measures of Central Tendency, Dispersion, Correlation & Graphic Representation

Q 8 What is statistics ? What are its uses and limitations in psychology ?

What is Statistics ?

Statistics play an important role in the present age. Statistics are extensively used in practically every field of knowledge such as education, psychology, economics, geography, etc. Statistics include collection of facts relating to any field of enquiry in a systematic manner and their analysis and interpretation.

The word 'statistics' is originated from a latin term 'status' which means state In the old times, numerical records were used to be kept in respect of the divisions of the state, their respective population, birth-rate, income etc The word 'statistics' was used for the first time by a German mathematician Gottfried Achenwall in 1749.

The term 'statistics' is used to convey two different meanings In plural use, statistics mean some systematic collection of numerical data about some particular topic. And in the singular use, it means the science of statistics In the general practice, statistics is used to mean the science of statistics and data or statistical data is used for the numerical variables

Definition

1. Statistical data—In the words of Horace Secrist, statistics are "aggregates of facts, affected to a marked extent by multiplicity of causes, numerically expressed, enumerated or estimated according to a reasonable standard of accuracy, collected in a systematic manner for a predetermined purpose and placed in relation to each other".

2. Science of statistics—The science of statistics can be

defined in this way. "Statistics may be defined as the collection, presentation, analysis and interpretation of numerical data." This definition of statistics includes all important methods of statistics, and thus is a very comprehensive definition of statistics.

Statistics in the Field of Psychology

Statistical methods are very widely used in the field of psychology. The following are the main usages of statistics in psychology—

1. *To measure intelligence*—In the absence of statistics, it is very difficult to keep a knowledge of the intelligence of millions of students of a country. Statistical methods are used to measure and record the intelligence, memory, taste, thinking, etc., of students and such data when analysed generally render very useful conclusions.

2. *To construct intelligence tests*—Statistics help in the construction of intelligence tests. These intelligence tests are based on the analysis of the past records of the intelligence of the students, and the importance of intelligence test in the field of education can hardly be exaggerated.

3. *To keep records of the educational institutions*—In all the educational institutions records are generally kept in respect of examination results, income and expenditure, number of students etc. Statistical methods are put into use in the keeping of such records.

4. *Predictions*—By analysing the past examination results, successful predictions can be made in respect of the future results.

Limitations of statistics

Despite its universality in application, the science of statistics has certain limitations. It is incorrect to assume that statistics produces always accurate and rigid conclusions, but if it is used by an expert in an unbiased and scientific way, the results produced are generally accurate and useful. The following are the main limitations of statistics.

(1) Statistics is a science of numerical values and as such, it does not study qualitative data.

(2) Statistical methods cannot be applied to individual items.

(3) Statistical laws are true on an average only.

(4) If the conclusions of statistical analysis are drawn without the proper context, they may mis-lead.

(5) The science of statistics is not as simple as it appears. Only specialists can use it successfully.

Q. 9. What factors should be kept in mind in deciding the size of class interval and the units of class-interval. *(Agra 1965)*

CLASSIFICATION

Meaning and Object

Statistical data have to be divided in homogeneous groups for the purposes of analysis and interpretation because unless and until it is properly classified it cannot be understood. "Classification is the process of arranging things (either actually or rationally) in groups or classes according to their resemblances and affinities, and gives expression to the unity of attributes that may subsist amongst a diversity of individuals."[1]

The main objects of classification are as follows—

(i) To simplify statistical data.

(ii) To distinguish between similarity and dissimilarity.

(iii) To make statistical data comparable.

(iv) To make a basis for tabulation.

Methods of Classification

1. Qualitative—Facts which cannot be represented in figures are known as attributes Literacy, Religion, Blindness, etc. are the examples of such attributes When these attributes are classified into different groups, the classification is called as classification according to attributes

2. Quantitative—Classification of numerical data is called as quantitative classification or classification according to class-intervals. The following are the main steps in the classification of quantitative data—

(i) *Class limits*—Each class has two limits upper and lower Figures falling within these two limits are classified in the class

(ii) *Magnitude*—The difference between the upper limit and the lower limit is called as magnitude of the class interval For example, if the upper limit of a class is 10 and the lower one is 5, the magnitude is $10-5=5$

(iii) *Class frequency*—Variables falling in a class-interval are known as class frequency

Construction of Classes

The first step in the construction of classes is to determine the number of classes It should be neither more nor much less and should be based upon the total number of items of the s[illegible] After finalising the number of classes their magnitude is decided The magnitude of the class intervals depend [illegible]

1. Connor, *Statistics* p. [illegible]

of the data and the number of classes. The formula for the ascertainment of magnitude is—

$$\frac{\text{Largest value} - \text{smallest value}}{\text{Number of classes}}$$

If, for example, the heights of 30 students are to be classified into two classes and the maximum height is 58″ and the minimum 46″, the magnitude will be—

$$\frac{58-46}{6}=\frac{12}{6}=2''$$

In this way, the classes will be 46−48, 48−50 and so on.

It should be noted in this connection that the magnitude of all classes should be equal and as far as possible the class limits of each class should be in round figures.

After deciding the number of classes to be constructed and their magnitude, each variable is classified in its relating class. Generally, tally sheets are prepared for this purpose. The method of tally sheets is simple and scientific.

Example—Classify the following items into 20 classes—

1, 14, 18, 22, 29, 30, 9, 14, 18, 25, 29, 33, 10, 15, 20, 25, 29, 35, 11, 16, 20, 25, 29, 39, 14, 18, 20, 27, 30 and 49.

Solution. The largest item = 49

The smallest item = 1

$$\therefore \text{ Magnitude } = \frac{49-1}{10}=\frac{48}{10}=4{\cdot}8 \text{ or } 5$$

Class interval	Tallies	Frequency
0-5	I	1
5-10	I	1
10-15		5
15-20		5
20-25	III	4
25-30	III	8
30-35	III	3
35-40	II	2
40-45		0
45-50	I	1

Variables whose values are just 5 or 10 can be classified either in 0-5 and 10-15 groups or in 5-10 and 15-20 groups respectively. But generally such values are classified in the next higher class and as such the item whose value is 5 will be classified in 5-10 class.

Q. 10. **What do you mean by measures of central tendency? Distinguish between mean, median and mode.** (*Agra 1963, 1962*)

(4) It is capable of further algebric treatment

Median

If the items of a series are arranged in ascending or descending order of magnitude, the item which falls in the middle of it is called Median. In the words of Connor, "The median is the value of the variable which divides *the group into two equal parts, one part* comprising all values greater, and other all values less than the median."[2]

While calculating median, first of all the items should be arranged in either ascending or descending order of magnitude. Then the following formula should be applied—

$$M=\left(\frac{n+1}{2}\right)\text{th item}$$

Where M stands for Median, and n stands for number of items

Example Calculate Median from the following items—

25, 15, 23, 40, 27, 25, 23, 25, 20.

Solution Arranging items in ascending order of magnitude

Serial No	Size of items
1	15
2	20
3	23
4	23
5	25
6	25
7	25
8	27
9	40

$M=\left(\frac{n+1}{2}\right)$th item = size of $\left(\frac{9+1}{2}\right)$th item

= Size of 5th item = 25

In the series of class-intervals, the following are the steps for the calculation of median—

(1) First of all the frequencies are cumulated.

(2) By using the formula $(n/2)$th item, median class is located

(3) Lastly, the following formula is applied

$$M=1+\frac{l}{f}(m-c)$$

Where M stands for median 1 for lower limit of the median class, l for magnitude of class-interval f for frequency of median-class, m for median number and c for cumulative frequency of group preceding the median group

2 Statistics in Theory and Practice p 19

$$a=\frac{\Sigma n}{n}=\frac{425}{10}=42{\cdot}5 \text{ Kgs.}$$

In a series of class-intervals, the formula for the calculation of mean is—

$$a=\frac{\Sigma mf}{n}$$

(Where 'a' stands for mean, $\Sigma\ mf$ for the product of frequencies multiplied by the mid-points of respective class-intervals, and n for number of items i. e., total frequency).

Illustration—Calculate the mean value of the following data—

Marks	Students
10-20	1
20-30	2
30-40	3
40-50	5
50-60	7
60-70	12
70-80	16
80-90	10
90-100	4

Solution

Class-interval (l)	Mid-point (m)	Frequency (f)	Mid-point × Frequency ($m \times f$)
10-20	15	1	15
20-30	25	2	50
30-40	35	3	105
40-50	45	5	225
50-60	55	7	385
60-70	65	12	780
70-80	75	16	1200
80-90	85	10	850
90-100	95	4	380
		$n=60$	$\Sigma mf=3990$

$$a=\frac{\Sigma mf}{n}$$

$$=\frac{3990}{60}$$

$$=66{\cdot}5 \text{ marks}$$

Properties of mean—(1) The total of the deviations of the variables from the mean is equal to zero.

(2) Combined mean of two or more series can be calculated.

Merits of mean—(1) The value of mean is always definite.

(2) It is easy to calculate and simple to understand.

(3) It is based on all the observations of a series.

(4) It is capable of further algebric treatment.

Median

If the items of a series are arranged in ascending or descending order of magnitude, the item which falls in the middle of it is called Median. In the words of Connor, "The median is the value of the variable which divides the group into two equal parts, one part comprising all values greater, and other all values less than the median."[2]

While calculating median, first of all the items should be arranged in either ascending or descending order of magnitude. Then the following formula should be applied—

$$M = \left(\frac{n+1}{2}\right)^{th} \text{ item}$$

Where M stands for Median, and n stands for number of items.

Example Calculate Median from the following items—

25, 15, 23, 40, 27, 25, 23, 25, 20

Solution Arranging items in ascending order of magnitude

Serial No	Size of items
1	15
2	20
3	23
4	23
5	25
6	25
7	25
8	27
9	40

$$M = \left(\frac{n+1}{2}\right)\text{th item} = \text{size of } \left(\frac{9+1}{2}\right)\text{th item}$$

$= \text{Size of 5th item} = 25$

In the series of class-intervals, the following are the steps for the calculation of median—

(1) First of all the frequencies are cumulated

(2) By using the formula $(n/2)$th item, median class is located.

(3) Lastly, the following formula is applied

$$M = l + \frac{i}{f}(m - c)$$

Where M stands for median, l for lower limit of the median class, i for magnitude of class-interval, f for frequency of median-class, m for median number and c for cumulative frequency of group preceding the median group

2 Statistics in Theory and Practice p 89

Example. Calculate median—

Marks	Frequency
0—10	8
10—20	30
20—30	40
30—40	12
40—50	10

Solution

Class-interval (*i*)	Frequency (*f*)	Cumulative-Frequency (*cP*)
0-10	8	8
10-20	30	38
20-30	40	78
30-40	12	90
40-50	10	100
	$n=100$	

$$M = \text{Size of } \left(\frac{n}{2}\right)\text{th item}$$

$$= \text{Size of } \left(\frac{100}{2}\right)\text{th item}$$

$$= \text{Size of 50th item}$$

The 50th item falls in 20-30 group. Therefore, 20-30 is median group.

$$M = 1 + \frac{i}{f}(m-c) = 20 + \frac{10}{50}(53-38)$$

$$= 20 + \frac{10}{40} \times 12 = 23 \text{ Marks}$$

Merits of median—

(1) It is easy to calculate and simple to understand.

(2) Its value is rigidly defined.

(3) Even if the values of extreme items are not known, it can be calculated if the number of items is known.

(4) It can be located merely by inspection some times.

(5) It can be calculated graphically.

Mode

Mode is "the value of the variable which occurs most frequently in a distribution." For example, in a series of 3, 5, 6 10, 11, 6, 15, 6, 19, 20, 6, the variable 6 has occured more frequently 4 times—Hence it is the mode of the series.

In an ordinary series of individual observations, the figure which occurs the maximum times is called mode. In a discrete series, the size whose frequency is highest is said to be mode. But

in a series of class-intervals, the location of the mode is a bit complicated. The following are the steps to calculate the value of mode.

(1) First of all, modal-group is to be located. The class-interval having highest frequency is called as the modal-group and it can be located, in most of the cases, merely by inspection.

(2) The following formula is used—

$$z = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Where z stands for Mode, l for lower limit of modal-group, f_1 for the frequency of modal-group, f_0 for the frequency of the group preceding the modal-group, f_2 for the frequency of the group just after the modal group and i for the magnitude of modal-group.

Example. Calculate Mode from the following—

Class-intervals	*Frequency*
5-10	10
10-15	12
15-20	16
20-25	14
25-30	10
30-35	8
35-40	15
40-45	5
45-50	4

Solution. Group 15-20 has the highest frequency, i. e., 16

Therefore, it is the modal group

$$z = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$= 15 + \frac{16 - 12}{32 - 12 - 14} \times 5 = 15 + \frac{4}{6} \times 5$$

$$= 15 + 3.34 = 18.34$$

Merits of mode—(1) It is very easy to calculate

(2) It can be located by graphic method also

(3) It can represent series at best because it is the value of that variable which occurs for the maximum times in that series

(4) For the determination of mode, it is not essential to know the values of all the items of a series If the point of maximum concentration is known, mode can be determined.

Sometimes, there are more than one mode in a series. If there are two or more points round which values of a series concen-

trate, there are as many modes as are the points of concentration. In such cases, it is very difficult to determine the value of mode. For example, in a series of 3, 5, 5, 6, 6, 3, 10, 5, 6, 8 and 7, there are two modes—5 & 6—both occur three times each. So which of these two modes are the actual and representative mode. In such cases when the series are bi-modal, tri-modal or multi-modal, the following formula should be used to determine the value of mode. This formula is based on the relationship of mode with median and mean.

$$Z=3M-2a$$

Where Z stands for Mode, M for Median and '*a*' for Mean.

Partition values

It has been described earlier that Median divides a series into two equal parts. Exactly on the same principle, the series can be divided into four, five, eight, ten or hundred parts and the values of these items are respectively known as Quartiles, Quintiles, Octiles, Deciles and Percentiles.

The calculation of these partition values is done by the same procedure with which the value of Median is determined. In this way,

1st Quartile or Q_1=the value of $\left[\frac{n+1}{4}\right]$th item

3rd Quartile or Q_3=the value of $\left[\frac{3(n+1)}{4}\right]$th item.

1st Quintile or Qn_5=the value of $\left[\frac{(n+1)}{5}\right]$th item.

3rd Decile or D_3=the value of $\left[\frac{3(n+1)}{10}\right]$th item.

69th Percentile or P_{69}=the value of $\left[\frac{69(n+1)}{100}\right]$th item.

In the case of a series of class-intervals, first of all the frequency is cumulated and then the groups are located in which Quartiles, Deciles, etc.. are included by the following formulae.

1st Quartile or Q_1=size of $\left[\frac{n}{4}\right]$th item.

3rd Quartile or Q_3=size of $\left[\frac{3(n)}{4}\right]$th item.

3rd Decile or D_3=size of $\left[\frac{3(n)}{10}\right]$th item.

72nd Percentile or P_{72}=size of $\left[\frac{72(n)}{100}\right]$th item.

and the like.

These items are then located in the respective class-interv: and the following type of formulae are used—

$$Q_1 = l + \frac{i}{f}(q_1 - c)\,;\quad D_1 = l + \frac{i}{f}(d_1 - c)$$

$$Q_3 = l + \frac{i}{f}(q_3 - c)\,;\quad P_{72} = l + \frac{i}{f}(P_{72} - c)$$

and the like.

Example. Calculate 1st and 3rd quartiles, 1st quintile, 3 decile and 65th percentile from the following series—

Class-interval	Frequency
50-60	11
60-70	17
70-80	32
80-90	28
90-100	12

Solution

Class-interval	Frequency	Cumulative frequency
50-60	11	11
60-70	17	28
70-80	32	60
80-90	28	88
90-100	12	100

1st Quartile or Q_1 = size of $\left(\frac{n}{4}\right)$th value or size of $\left(\frac{100}{4}\right)$th ite

=25th item which lies in (60-70) class

$$\because \quad Q_1 = l + \frac{i}{f}(q_1 - c)$$

$$= 60 + \frac{10}{17}(25 - 11)$$

$$= 60 + \frac{10 \times 14}{17} = 68.24$$

3rd Quartile or Q_3 = size of $\left[\frac{3(n)}{4}\right]$th item

= size of $\left[\frac{100}{4}\right]$th item

= size of 75th item which lies in (80-90) class

$$\therefore \quad Q_3 = l + \frac{i}{f}(q_3 - c)$$

$$= 80 + \frac{10}{28}(75 - 60)$$

$$= 80 + \frac{10 \cdot 15}{28} = 85.36$$

1st Quintile or Qn_1 = size of $\left(\frac{n}{5}\right)$th item

$$= \text{size of } \left(\frac{100}{5}\right)\text{th item}$$

= size of 20th item which lies is (60-70) class

$$\therefore \quad Qn_1 = 1 + \frac{i}{f}(qn_1 - c)$$

$$= 60 + \frac{10}{17}(20 - 11)$$

$$= 60 + \frac{10 \times 9}{17}$$

$$= 65{\cdot}29$$

3rd Decile or D_3 = size of $\left[\frac{3\,(n)}{10}\right]$th item

$$= \text{size of } \left[\frac{3\,(100)}{10}\right]\text{th item}$$

= size of 30th item which falls in (70-80) class

$$\therefore \quad D_3 = 1 + \frac{i}{f}(d_3 - c)$$

$$= 70 + \frac{10}{32}(30 - 28)$$

$$= 70 + \frac{10 \times 2}{32} = 70{\cdot}62$$

65th Percentile or P_{65} = size of $\left[\frac{65\,(n)}{100}\right]$th item

$$= \text{size of } \left[\frac{65(100)}{100}\right]\text{th item}$$

= size of 65th item which falls in (80-90) class

$$\therefore \quad P_{65} = 1 + \frac{i}{f}(P_{65} - c)$$

$$= 80 + \frac{10}{28}(65 - 60)$$

$$= 80 + \frac{10 \times 5}{28} = 81{\cdot}78$$

Q. 11. Write short note on Measures of Dispersion.

MEASURES OF DISPERSION

Dispersion is the average of the second order. It refers to the variability in the size of item. Dispersion is the variation of the variables of a series from its average. The main function of dispersion is to know the difference between various variables of a series and its average. The reliability of an average depends, to an

1st Quintile or Qn_1 = size of $\left(\frac{n}{5}\right)$th item

$=$ size of $\left(\frac{100}{5}\right)$th item

$=$ size of 20th item which lies is (60-70) class

$\therefore \quad Qn_1 = l + \frac{i}{f}(qn_1 - c)$

$= 60 + \frac{10}{17}(20 - 11)$

$= 60 + \frac{10 \times 9}{17}$

$= 65{\cdot}29$

3rd Decile or D_3 = size of $\left[\frac{3(n)}{10}\right]$th item

$=$ size of $\left[\frac{3(100)}{10}\right]$th item

$=$ size of 30th item which falls in (70-80) class

$\therefore \quad D_3 = l + \frac{i}{f}(d_3 - c)$

$= 70 + \frac{10}{32}(30 - 28)$

$= 70 + \frac{10 \times 2}{32} = 70{\cdot}62$

65th Percentile or P_{65} = size of $\left[\frac{65(n)}{100}\right]$th item

$=$ size of $\left[\frac{65(100)}{100}\right]$th item

$=$ size of 65th item which falls in (80-90) class

$\therefore \quad P_{65} = l + \frac{i}{f}(P_{65} - c)$

$= 80 + \frac{10}{28}(65 - 60)$

$= 80 + \frac{10 \times 5}{28} = 81{\cdot}78$

Q. 11. Write short note on Measures of Dispersion.

MEASURES OF DISPERSION

Dispersion is the average of the second order. It refers to the ariability in the size of item. Dispersion is the variation of the riables of a series from its average. The main function of spersion is to know the difference between various variables of a ies and its average. The reliability of an average depends, to an

extent, upon the dispersion of the series. If the dispersion is less in degree, the average is more representative of the series and vice versa.

Measures of dispersion

The following are the main measures of dispersion—

(1) Range.

(2) Quartile deviation.

(3) Mean deviation.

(4) Standard deviation.

1. Range—Range is the simplest measure of dispersion Precisely, it is the difference between the highest value and the lowest value of the series For example, a group consists of the following variables—11, 12, 15, 19, 23, 13, 17, 20, 21, and 8, the range of this series will be—

Highest value—Smallest value

or $23-8=15$

But range is not a popular measure of dispersion as it gives only a general idea of the scatter of the group and not an accurate estimate. However, it is very easy to determine and simple to *understand.*

2. Quartile deviation—Quartile deviation is one-half of the difference between the third quartile and the first quartile of a series Generally, it is called as Semi-inter Quartile Range. The *following is the formula for its calculation*—

$$Q.\ D.=\frac{Q_3-Q_1}{2}$$

Where $Q.\ D$ stands for Quartile Deviation

Q_3 for Third Quartile

and Q_1 for First Quartile

Example. Calculate the semi-inter Quartile Range of the following—

Class-interval	6-7	7-8	8-9	9-10	10-11	11-12	12-13
Frequency	14	20	42	54	46	18	6

Solution

Class-interval	Frequency	Cumulative frequency
(i)	(f)	(cf)
6-7	14	14
7-8	20	34
8-9	42	76
9-10	54	130
10-11	46	176
11-12	18	194
12-13	6	200

$$Q_1 = \text{size of } \left(\frac{n}{4}\right)\text{th item}$$

$$= \text{size of } \left(\frac{200}{4}\right)\text{th item}$$

$$= \text{size of 50th item which is in (8—9) group}$$

$$Q_1 = 1 + \frac{i}{f}\,(q_1 - c)$$

$$= 8 + \frac{1}{42}\,(50 - 34)$$

$$= 8 + \frac{1 \times 16}{42} = 8{\cdot}38$$

$$Q_3 = \text{size of } 3\left(\frac{n}{4}\right)\text{th item}$$

$$= \text{size of } 3\left(\frac{200}{4}\right)\text{th item}$$

$$= \text{size of 150th item which is in (10 - 11) group.}$$

$$Q_3 = 1 + \frac{i}{f}\,(q_3 - c)$$

$$= 10 + \frac{1}{46}\,(150 - 130)$$

$$= 10 + \frac{1 \times 20}{64} = 10{\cdot}44$$

$$Q.\,D. = \frac{Q_3 - Q_1}{2}$$

$$= \frac{10{\cdot}44 - 8{\cdot}38}{2} = 1{\cdot}03$$

3. *Mean deviation*—In statistics, this measure of dispersion is quite important. Mean deviation of a series is the average of the deviations of various items from either mean, mode or median. In calculation of the deviations of various items from a measure of central tendency, algebric signs (+ or —) are totally ignord. The following are the different formulae for the calculation of mean deviation :—

(i) $\delta = \frac{\Sigma d}{n}$

Where δ stands for Mean Deviation
Σd sum of deviations from Mean
and n for total items

(ii) $\delta = \frac{\Sigma dn}{n}$

Where Σdn stands for sum of deviations from Median and n for total number of items

(iii) $\delta = \frac{\Sigma dz}{n}$

Where Σdz stands for sum of deviations from mode and n for total number of item.

In the series of class-intervals also the above formulae are applied but the deviations are multiplied with their respective frequencies.

Example Calculate the mean deviation of the series from arithmetic mean and Median.

Class-interval	0-10	10-20	20-30	30-40	40-50
Frequency	5	7	20	8	5

Solution—

Class-interval (i)	Mid-point (m)	Frequency (f)	Comulative frequency (cf)	Deviations from mean (d)	(fxd)	Deviations from median (dn)	$(dmxf)$
0-10	5	5	5	20 2	101 0	20 5	102 5
10-20	15	7	12	10 2	71 4	10 5	73 5
20-30	25	20	32	2	4 0	·5	10 0
30-40	35	8	40	9 8	78 5	9 5	76 0
40-50	45	5	45	19 8	99 0	19 5	97 5
		$n=45$	$n=45$		$\Sigma fd=353\ 8$		$\Sigma fdm=359\ 5$

Arithmetic mean $= 25\ 2$

Median $= 25\ 5$

Mean deviation from mean $= \frac{\Sigma fd}{n}$

$= \frac{353\ 8}{45} = 7\ 8$

Mean deviation from median $= \frac{\Sigma fdm}{n}$

$= \frac{359\ 5}{46} = 7\ 9$

In the same way, Mean deviation can be calculated from mode also.

4 *Standard deviation*—This is the most important measure of dispersion Standard deviation is the square root of the arithmetic average of the squares of deviations measured from the value of mean of the series The most important difference between mean deviation and standard deviation is that algebric signs (+,—) are not ignored in the calculation of standard deviation, and hence, it is more accurate and justified measure of dispersion

Standard deviation is calculated by the following formula—

Standard deviation or $6=\sqrt{\left(\frac{\Sigma^2 d}{n}\right)}$

Where Σd^2 stands for the sum of squares of deviation from mean, and n stands for the total number of items.

Example—Calculate standard deviation of the following figures—

4, 6, 9, 10, 15, 25

Solution—

Items	Deviations from mean (d)	Deviations squared (d^2)
4	−7·5	56·25
6	−5·5	30·25
9	−2·5	6·26
10	−1·5	2·25
15	+3 5	12·25
25	+13·5	182 25
$n=6$		Σd^2. 289·50

$$\text{Standard deviation}=\sqrt{\left(\frac{\Sigma d^2}{n}\right)}$$

$$=\sqrt{\left(\frac{289·5}{6}\right)}$$

$$=\sqrt{(48·25)}$$

$$=6·9$$

In the series of class-intervals, the following formula is applied—

$$=6\sqrt{\left(\frac{\Sigma fd^2}{n}\right)}$$

Example. Calculate the standard deviation from the following—

Class-interval	Frequency
5·5 – 6·5	3
6·5 – 7·5	6
7·5 – 8·5	9
8·5 – 9·5	13
9·5 – 10·5	8
10·5 – 11·5	5
11·5 – 12·5	4
	48

Solution—

Class-interval	Mid point	Frequency		Deviations from mean	Deviations squared up	Squared deviations x frequency
(i)	(m)	(f)	(m×f)	(d)	(d^2)	($f×d^2$)
5·5—6·5	6	3	18	—3	9	27
6·5—7·5	7	6	42	—2	4	24
7·5—8·5	8	9	72	—1	1	9
8·5—9·5	9	13	117	0	0	0
9·5—10·5	10	8	80	+1	1	8
10·5—11·5	11	5	55	+2	4	20
11·5—12·5	12	4	48	+3	9	36
		n=48	432			Σfd^2=124

$=\Sigma mf$

Arithmetic mean $=\frac{\Sigma mf}{n}$

$=\frac{432}{48}=9$

Standard deviation $=\sqrt{\left(\frac{\Sigma fd^2}{n}\right)}$

$=\sqrt{\left(\frac{124}{48}\right)}$

$=\sqrt{2 \cdot 58}=1 \cdot 6$

Q 12. What is correlation ? How is it calculated ?

CORRELATION

Statistical methods are used to measure and compare intelligence, memory, income, height and weight etc in the field of education. It is a very common experience that when data pertaining to some field of enquiry are arranged in a systematic manner, there appears to be a type of relationship between the different groups of data. This relationship is called as correlation For example, if figures regarding the height and weight of students are collected, and then arranged in appropriate groups, it can be found out that with an increase in height, the weight also increases Thus there is correlation between these two series of statistical data. The degree in correlation is expressed in figures ranging from 0 to +1 and 0 to −1

Correlation is of two types Positive and Negative

1 Positive correlation—If the weight of a student increases in proportion to increase in his height, the relation between this increase of weight and height is called as positive correlation It ranges from 0 to +1 If it is 0, then there is no relati

And when it is +1, then there is perfect positive correlation. But if the degree of correlation is +·5 or +·58 etc., it is known as partial positive correlation.

2. *Negative correlation*—It is just the opposite of positive correlation. If the weight of a student does not increase in proportion to increase in his height, or in other words, if the weight of a student decreases with an increase in height, then it is said to be Negative correlation. It also ranges from 0 to −1, −1 is Perfect Negative Correlation.

It should be noted in this connection that correlation can never exceed +1 or −1.

Correlation is very important in the sphere of education because it is the tool by which two or more series of facts can be compared and important and vital conclusions can be drawn.

CALCULATION OF CORRELATION

There are several methods to calculate correlation, but Karl Pearson's formula is by far the best, it is

$$r = \frac{\Sigma xy}{n \times b_1 \times b_2}$$

where r stands for correlation, $\Sigma\ xy$

n for number of variables, b_1 for standard deviation of 1st series and b_2 for standard deviation of 2nd series.

Example. Calculate the coefficient of correlation of the height of fathers and sons of the following series.

Height of father	65″	66″	67″	67″	68″	69″	70″	71″
Height of son	67″	68″	65″	68″	72″	72″	69″	71″

Solution

Height of father (m_1)	Deviations from mean (x)	Deviations squared (x^2)	Height of son (m_2)	Deviations from mean (y)	Deviations squared (y^2)	($x \times y$)
65	−3	9	67	−2	4	+6
66	2	4	68	−1	1	+2
67	1	1	65	−4	16	+4
67	1	1	68	−1	1	+1
68	0	0	72	+3	9	0
69	+2	1	72	+3	9	+3
70	+2	4	69	0	0	0
72	+4	16	71	+2	4	+8
544			522			
$n=8$		$\Sigma x^2 = 36$	$n=8$		$\Sigma y^2 = 44$	$\Sigma xy = 24$

Arithmetic mean $m_1 = \frac{544}{8} = 68''$.

Arithmetic mean of $m_2 = \frac{525}{8} = 69''$.

Standard deviation of $m_1 = \sqrt{\frac{\Sigma x^2}{n}} = \sqrt{\frac{36}{8}} = 2{\cdot}12$

Standard deviation of $m_2 = \sqrt{\frac{\Sigma y_2}{n}} = \sqrt{\frac{44}{8}} = 2{\cdot}34$.

Correlation $r = \frac{\Sigma xy}{n \times \sigma_1 \times \sigma_2}$

$= \frac{+24}{8 \times 2{\cdot}12 \times 2{\cdot}34} = +{\cdot}6.$

Short cut method

Co-efficient of correlation can be calculated by a short cut method also. Under this method the arithmetic mean and the standard deviations of the two methods are not to be calculated. But deviations are taken from an assumed mean and the following formula is used

$$r = \frac{\Sigma xy - \left(\frac{\Sigma x \times \Sigma y}{n}\right)}{\sqrt{\left(\Sigma x^2 - \frac{\Sigma x^2}{n}\right)\left(\Sigma y^2 - \frac{(\Sigma y)}{n}\right)}}$$

where r stands for the coefficient of correlation.

Σxy stands for the sum of deviations from mean of the products of deviation from the assumed averages

Σx stands for the sum of deviations from mean of x series

Σy stands for the sum of deviations from mean of y series

n stands for the total number of items

Σx^2 stands for the sum of squares of deviations of x series

Σy^2 stands for the sum of squares of deviations of y series.

Example. Calculate the co-efficient of correlation of the following—

Series A	Series B
160	292
164	280
172	260
182	234
166	266
170	254
178	230
192	190
186	200

Solution

Series A	Deviations from Assumed average	Deviations squared	Series B	Deviations from Assumed average	Deviations squared	
	(x)	(a^2)		(y)	(y^2)	(xy)
160	—18	324	292	+38	1444	—684
164	—14	196	280	+26	676	—364
172	— 6	36	260	+ 6	36	— 36
182	+ 4	16	234	—20	400	— 80
166	—92	144	266	+12	144	—144
170	— 8	64	254	0	0	0
178	0	0	230	—24	576	0
192	+14	196	190	—64	4096	— 6
186	+ 8	64	200	—54	2916	—896
	—32	1040		—80	10288	—2310
$n=9$	Σx	Σx^2	$n=9$	Σy	Σy^2	Σxy

$$r=\frac{\Sigma xy-\left(\frac{\Sigma x\times\Sigma y}{n}\right)}{\sqrt{\left[\left(\Sigma x^2-\frac{(\Sigma x)^2}{n}\right)\left(\Sigma y^2-\frac{(\Sigma y)^2}{n}\right)\right]}}$$

$$=\frac{-2310-\left(\frac{-32\times 80}{9}\right)}{\sqrt{\left[\left(1040-\frac{(-32)^2}{9}\right)\left(10288-\frac{(-80)^2}{9}\right)\right]}}$$

$$=\frac{-2310-284{\cdot}4}{\sqrt{[(1040-113{\cdot}8)(10288-711{\cdot}1)]}}$$

$$=\frac{2594{\cdot}4}{2978{\cdot}4}=-{\cdot}87$$

Spearman's formula—Spearman was the first in the field of education who measured the extent of correlation by the method of "Rank Differences". The formula is as following—

$$r=1-\frac{6\Sigma d^2}{n(n^2-1)}$$

Where r stands for coefficient of correlation, Σd^2 for the total of the squares of the differences of corresponding ranks and n for the number of items.

The following are the steps to be followed under this method—

(1) Find out the rank of each item of the series beginning from either highest or the lowest value.

(2) Find out the difference between the ranks of the two series.

(3) Square up the differences.

(4) Apply the following formula—

$$r = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

Note—*If there are two or more items in the series having the same value, then their ranks will be the 'average rank' of those ranks which they would have got.*

Example	English	Mathematics
A	60	10
B	50	6
C	50	8
D	40	8
E	60	7
F	30	4
G	35	5
H	50	7

Solution

Student	English	Mathematics	R^1	R^2	d	d^2
A	60	10	1.5	1	·5	·25
B	50	6	4	6	—2	4·00
C	50	8	4	2.5	1.5	2.25
D	40	8	6	2.5	3.5	12.25
E	60	7	1.5	4.5	—3	9.00
F	30	4	8	8	0	0
G	35	5	7	7	0	0
H	50	7	4	4.5	—·5	25
						28.00 Σd^2

$$r = 1 - \frac{6\Sigma d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 28}{8(8^2-1)} = 1 - \frac{168}{8 \times 63}$$

$$= 1 - \frac{168}{504} = 1 - 3 = 7$$

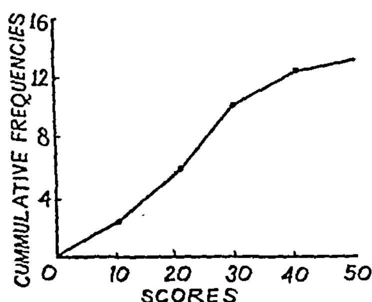
Q 13 Write short note on—Graphic representasion of data

Graphic Representation of Data

Statistical data can be presented by way of graphs also In education, this graphic representation of data is quite popular because the graphs are easy to understand and present to approximate figure of the data. *Graphs can be constructed by the following methods—*

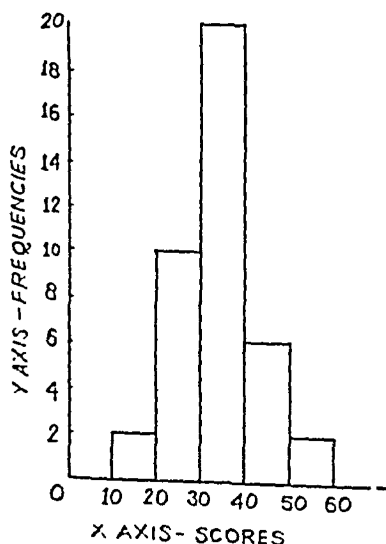
1. Construction of a Histogram—As is clear by the name, a histogram is constructed in the form of rectangles and when plotted on a graph paper, takes shape of a bar diagram. A histogram is constructed in this way. First of all *x* axis and *y* axis are plotted on the graph paper. X axis represents the sizes of the class-interval and *y* axis represents frequencies.

Points are marked on the basis of class-intervals and their respective frequencies on both the axis. These points are connected and thus rectangles are constructed for each class-interval and its frequency. All these rectangles form a histogram.



2. Construction of a frequency polygon—In a frequency polygon, the points are not converted into rectangles, but a curve is drawn by connecting all these points. The curved figure is called a frequency polygon.

3. Construction of a cumulative frequency curve—While constructing a cumulative frequency curve, the frequency of the given distribution is cumulated. Then '*x*' axis and '*y*' axis are plotted on the graph. Cumulative frequencies are plotted on the *y* axis and sizes are marked on the *x* axis. The points when connected form the shape of a cumulative frequency curve or an ogive curve.



Cumulative frequency curve is very useful to locate the values of median and other partition values.

4
Nervous System

Q. 14 Show the relations between Psychology and Physiology.

PSYCHOLOGY AND PHYSIOLOGY

Psychology is the positive science of behaviour. Physiology studies the physical activities and structure. It is the science of physical body It studies the respiration, circulation of blood, glandular activities and muscular activities etc All these influence behaviour in some way or the other. There is a saying, "Healthy mind in a healthy body" Hence psychology and physiology are closely related. Some sort of correlation can be observed between *mental states and physical conditions* *Neuroses and psychoses* are closely related and the appearance of one generally leads to that *of other. It has been very well proved from psychological experi*ments that mental processes have a far reaching effect on physical activities

On the basis of this close relation of the mental behaviour and physical states, some scholars have conceived psychology as a branch of physiology. Mind, according to them, is only a function of the brain. According to this view, consciousness is the result of certain activities of the physical body But this view has been proved to be false both from logical and factual points of view The study of the physical processes helps in the understanding of mental behaviour, but this should not lead to the identification of both. Hence psychology is not a branch of physiology

The fields of psychology and physiology are separate and different The field of physiology lies in physical activities while that of psychology lies in mental activities and behaviour The standpoints of psychology and physiology are also different Physiology studies the different physical activities separately Psychology studies the reaction of the whole physical organism towards the external stimulus.

Due to the close relation of the physical and mental activities, a separate branch of psychology known as physiological psychology has been established for the psychological study of the physical

processes. According to Hoffding, "Physiological psychology is based upon the close connection of mental life with organic life in general." Physiological psychology studies the physical activities connected with mental processes. In it, the sense organs, nervous system, organism, brain, muscles, blood circulation and respiration etc., are studied. All these also form the subject matter of physiology. But whereas in physiology these are separately studied, physiological psychology studies them as part of the behaviour of the whole organism.

Physiology studies endocrine glands. Physiological psychology discovers their psychological influences. This search has revealed much valuable information which has disclosed the causes of various physical and psychological processes.

A special branch of physiological psychology is known as Psycho-physics. In it the different physical activities are quantitatively studied. For example, Psycho-physics has discovered through experiments on the stimuli of different sense organs how much difference there should be between two stimuli so that the difference may be observed. The famous law known as Weber-Fechner Law points out the quantity of least noticeable difference in the stimuli of different sense organs.

From the above discussion it is clear that though psychology and physiology are independent, yet they are closely related.

Q. 15. Describe in broad outline the nervous system considered as a stimulus—response mechanism. *(Poona 1960)*

Describe the stimulus response mechanism. How does it help in explaining human behaviour ? *(Mysore 1962)*

Ans. Response Mechanism is that system which helps the organism to adjust itself to the environment and controls its activities. Thus it is due to response mechanism that one finds selection, adjustment, combination etc., in human behaviour. The response mechanism in animals is divided into the following parts :

1. *Receptors*—Cells of the eyes, nose, ears, tongue and skin etc., are receptors. They receive the sensations. Human behaviour begins through the receptors. It is only after the receptors have received the sensation that the response in the organism begins.

2. *Effectors*—Effectors include muscles and glands. They make the actual response possible.

3. *Nervous system*—Nervous system controls the response. It joins the receptors and motor-organs.

Human organism is affected by the environment. The sun,

heat, cold etc , affect our body. The body responds to external stimuli. This response changes the external environment. When something pinches, the pinched one feels a sensation. The sensation is received by the nervous system through which the receptors and motor organs are connected and the muscles of the hand re-act immediately so that the pinching object is removed. Thus the receptors receive stimuli from the environment and the motor organs change the environment by response. The human organism has innumerable receptor-cells. In the eye alone there are lakhs of cells. Similarly, the receptor organs e. g , muscles etc., have innumerable muscles-fibres. The nerves connect the receptors and the muscles and thus make response possible These nerves carry the message from the receptors to the muscles. This communication has a speed of 75 Yds., a second This response takes a very small portion of a second. In times of emergency it becomes even more rapid.

NERVOUS SYSTEM

Nerve is the most important part of response mechanism. It joins the receptors and the effectors The nervous system is divided into two parts (1) Central nervous system and (2) Autonomic nervous system In the human organism there is a whole net work of nerves and this net work presents the structure of the nervous system.

CENTRAL NERVOUS SYSTEM

The central nervous system is an important part of the response mechanism The central nervous system is divided into two parts . (1) The Spinal cord and (2) The Brain

The spinal cord is situated in the back bone It is a white matter having a form as that of a rope Its upper part is made of white matter while the inner part is that of grey matter The spinal cord has two types of nerves (1) Sensory or afferent and (2) Motor or efferent. These nerves join the receptor and the motor organ The sensory nerves carry the muscles from the receptor to the centre of the nervous system The motor nerves carry the message from the nervous system to the muscles. This coming and going of the messages is through the grey matter of the spinal cord The grey matter forms 50% of the spinal cord and the rest is covered by the white matter The path ways of spinal cord are situated just beneath the skin. Its middle part has cell bodies and the nerve path-ways are in its peripheral portion. In the white matter there are tracts up-side and down-side In the

grey matter there are associative nerves.

The spinal cord controls the reflex aciton. In the reflex-action the sensory nerves carry the sensation to the brain and from the brain the motor nerves carry the message to the muscles. This reaction is so rapid that it takes almost no time. Besides controlling the reflex action, the spinal cord also joins the external organs with the brain. In it 31 pairs of nerves come from out side. Every pair has a sensory and a motor nerve. These nerves join the spinal cord with the external parts of the body. Thus the external parts *viz.*, hands, feet etc. are governed by the spinal cord. It controls all the learned activities like writing, reading, cycling, typing, walking, running and talking etc. The brain has not to interfere in all these activities.

BRAIN

Besides the spinal cord, there is yet another important part of the central nervous system called the brain. The brain is divided into the following three parts :—

(1) Cerebrum, (2) Cerebellum and (3) Mid brain or Medulla oblongata or Brain Stem.

The cerebrum is bigger than the cerebellum or brain stem. Hence it is known as cerebrum or big brain. It is extended from the eye brows upto the centre of the skull. Thus it is the foremost part of the skull. It is also the driest part of the brain. In it the arrangement of the white and the grey matter is opposite to that of the spinal cord. Its upper part is made up of grey matter while the inner is made of white matter. As it has been said earlier, in the spinal cord the upper part is made of white matter while the inner part is made of grey matter. The upper part of grey matter in the cerebrum is known as the cortex. Near it there are groups of nerve cells which form the sensory area and motor area of the in. The white matter forms the nerve-fibres. The grey matter rms the nerve cells.

(1) Cerebrum

In cerebrum there are two hemispheres, separated by a fissure. These hemispheres are called the right hemisphere and the left hemisphere. The right hemisphere is mostly connected with the left part of the body. The left hemisphere is mostly connected with the right part of it. Thus there is a cross relation between the hemispheres of the cerebrum and the parts of the body. On the surface of the cerebrum there are small convolutions or gyres. These convolutions are separated by fissures. These fissures are

deep in the matter of the cerebrum. But they do not divide the brain, because under the surface its various parts are linked with each other. There is a fissure in the centre of cerebrum which is known as the central sulcus. It is also called fissure of Rolando. Besides this there is a fissure in the cerebrum vertically. It is called the fissure of Silvious or Lateral Sulcus.

The big parts of the cerebrum are known as lobes. The lobes are inter-connected. The cerebrum is divided into four lobes. These lobes are as follows :

1 *Frontal Lobe*—Frontal lobe is extended from the fissure of lateral sulcus to the fissure of central sulcus.

2 *Parietal Lobe*—Parietal lobe is extended from the fissure of central sulcus to the hind part of the head.

3. *Occipital Lobe*—This lobe is in the hind part of the head.

4. *Temporal Lobe*—Temporal lobe is the portion beneath the brain.

These lobes of the brain are linked by sensory projection fibres. These fibres enter from one lobe to another.

(2) Mid Brain

The second part of the brain is the brain stem or medulla oblongata It is through this part that sensations sent to the spinal cord reach the brain and the responses from the brain reach the lower part of the spinal cord The work of the spinal cord has already been described earlier

(3) Cerebellum

The cerebellum is the third part of the brain. It is situated in the portion behind cerebrum. It is divided into two lobes. Inside these lobes there are white nerve fibres which are covered by a thin layer of the grey cells There are some fissures in this part which are deeper than those of the cerebrum. The cerebrum controls the kinaesthetic movements and co-ordinates the musclar activities.

Q 16 Write a short note on—Autonomous Nervous System.
(Agra 1955, Lucknow 1957, Bombay 1958)

Autonomic Nervous System is an important part of the nervous system in the human organism It is known as autonomic nervous system, because it is independent of the central nervous system in its action. There is no interference in its activities from the central nervous system For example, in the emotional state there are many changes in the body which are governed by autonomic nervous system and in which the central nervous

system takes no part. But this does not mean that the autonomic nervous system has no relation with the central nervous system. As a matter of fact the spinal cord which is the important part of the central nervous system has also an important role in the autonomic nervous system. Hence it can be said to be autonomous only in the sense that it controls and governs all those activities in which the brain has nothing to do. The activities of this system cannot be checked even with efforts. It goes on acting independently.

The main function of the autonomic nervous system is the adjustment between the activities of the different parts of the body. Many of its nerves beginning from the brain and the spinal cord reach the stomach and nerves carrying blood. These nerves control the activities of the internal and external muscles. It is the autonomic nrvous system which controls the activity of the glands, the stomach and the blood vessels. It is the system which controls the activity of the different parts of the body, e. g., lungs, heart, liver, spleen, rectum, sweat glands etc. Thus as a matter of fact this is a motor nervous system. Many of the ganglia of its nerves, cells and also the synapses are situated outside the central nervous system and central nervous system takes no part in their activities.

The left part of the autonomic nervous system is divided into three parts as follows :

(1) Cranial (2) Thoraco Lumber and (3) Sacrel. The thoraco lumber is the part from the brain stem to sacrel. The reason to call it thoraco lumber is that the nerves of this part reach the thorax, beginning from the spinal-cord. Below thoraco lumber and in the lowest part of the spinal cord, is the sacrel.

The autonomic nerves and the different parts of the body are connected up to eyes, salivary glands, mucous membrane, blood vessels, heart, liver, stomach, pancreas, intestines, adrenals, kidneys, bladder, colon, rectum and genital areas. Besides these are also extended upto sweat glands and cutaneous vessels. The ganglia and spinal cord are linked by those nerve fibres which reach the ganglia from the spinal cord. In a ganglia there are 22 sympathetic ganglion. The sympathetic ganglion are on the upper surface of the white matter, known as myline. The axon fibres beginning from the ganglia return again to the nerves of the spinal cord.

The autonomic nervous system is divided into two parts : (1) Sympathetic nervous system and (2) Para-sympathetic nervous

system. The activities of both these parts are opposite to each other.

Sympathetic Nervous System

The sympathetic nervous system prepares the body for emergency. It saves the body in the time of emergency. It also works in emotional states. Due to its activity the retina of the eye acts at the time of emergency and the blood vessels of the stomach send more blood to the muscles, and brain instead of sending blood to the stomach. As a result of this the digestion stops and so also hunger. The muscles and the brain begin to work rapidly as the intestines stop working and the gastric glands stop giving secretions The heart beats with a speed since it has to pump blood rapidly. The adrenal glands execrate adrenalin. As a result of adrenalin the blood sugar is increased in the blood resulting into increase of strength in man Excitement results in the destruction of many cells and the rate of respiration is increased. The water metabolism drops down resulting in dryness in throat and mouth. All these activities can be seen at the time of quarrel or fighting, anger or fear In the emotional state, the galvanic response capacity also becomes less

Para-sympathetic Nervous system

Another part of the autonomic nerves is para sympathetic nervous system. It is the link with cranial and sacrel The main work of para-sympathetic system is anabolism It includes the concentration of the energy of the body and strengthening of the different parts of the body by this concentration As the activity of the sympathetic nervous system decreases the speed of the heart beat is lessened and the blood pressure also becomes less The activity of the salivary glands increases which helps in digestion, resulting in increase in the weight of body The pupils of the eyes contract resulting into relaxation of the eyes The para-sympathetic nervous system controls the activity of the sacrel division. It keeps the blodder, the colon and the rectum healthy and helps in execrating the different kinds of useless and poisonous matter from the body.

The sympathetic and para-sympathetic nervous system differ from each other as explained below :—

(1) In the sympathetic nervous system the ganglion are in the spinal cord near those internal organs of the body, which they

excite. But in the para-sympathetic nervous system the gangalion are not in the spinal cord but near bodily organs.

(2) In the sympathetic nervous system the whole system works together, but in the para-sympathetic nervous system the different pairs are independent.

But this does not mean that the sympathetic and the para-sympathetic nervous systems are absolutely opposite to each other and they are not related. As a matter of fact they co-operate inspite of these distinctions. According to Morgan these systems do not work independent of each other but co-operate in different proportion according to different situations, *e. g.*, if the organism has to struggle with the environment, the sympathetic system works more and the para-sympathetic system is less active. In the adjustment with environment the parasympathetic system has to work more while the sympathetic system works less. Thus due to the co-operation of the sympathetic and parasympathetic systems, there is a balance in the body in both the states of work and rest.

Q. 17. **Describe briefly the function of the endocrine glands.**

(Gorakhpur 1960, 61; Agra 1954)

Ans. Ductless glands, as is clear from the name, send their secretion directly in the blood without the help of ducts. Their secretion is known as hormones. It has a very far reaching influence on the body and personality. The main ductless glands are pineal, thyroid, adrenal and sex glands. Besides these the parathyroid, thymus and other glands also exert an important influence on the physical processes. The contribution of the main ductless gland in the response mechanism and personality of man will be clear from their description.

(*1*) *Pineal Gland*—Pineal gland is known as master gland, because it controls other glands. Its posterior lobe scretes such hormones which keep the water metabolism and blood pressure of the body in balance. The hormones of the frontal lobes keep the thyroid, sex and external glands etc., under control and make for their development and efficiency.

(2) *Thyroid Gland*—The hormones secreted from the thyroid gland are known as thyroxine. Thyroxine continues the chemical processes in the body like metabolism and oxidation. Its increase increases the speed of metabolism. Its decrease decreases the speed of metabolism and less oxygen is used.

(3) *Adrenal Glands*—Adrenal gland has two parts. The external part is known as cortex while the internal part is known as *medulla*. The cortex secretes cortin The medulla secretes the hormones known as andrenin. These hormones are very powerful Even the presence of the small quantities of them in the blood results in fast *heart beat*, *high blood presssure*, *postponement of* the activity of stomach and intestines, broadening of the air paths, discharge of sugar from liver, absence of fatigue in the muscles, profuse sweating, expansion of the pupil of the eye etc. These changes can be seen in the emotional state of the organism which organises its power to face an emergency.

Cortin has far reaching influence on muscles and sexual functions. It is due to this that the body uses sodium, potassium and sugar. It keeps the body fit and hence it is absolutely necessary for the body. In its absence a disease known as Addison's disease, develops *in the* body The symptoms of this disease are weakness lack of interest in sexual functions, slow metabolism, lack of sleep, blackening of the skin, lack of the capacity to bear heat and cold etc. *All these symptoms disappear by giving cortin to the body.* The increase in cortin results in excessive development of the manly qualities. Its excess in the female leads to the disappearance of rounded contours, the voice becomes harsh and hairs are observed on the face.

(4) *Sex Glands*—Sex glands create primary sense organs, female ovary, male testes, ovum and supermetozoon Besides these the sex glands also create some internal hormones. Of these some are present in both male and female In the males these hormones lead to the manly qualities while in the female they develop feminine qualities. It is due to their influence that the sex organs develop at the stage of puberty Again it is due to these that the sexual characteristics of males and females such as the development of mammary *glands in the female and beard and moustaches in males occurs* In their absence these sexual characteristics do not develop and both males and females remain neutral The hormones of the sexual glands are present in childhood, and develop when one reaches adolescence They control the female activities connected with reproduction *such as menstrual cycle, pregnancy etc*

The above mentioned importarce of the ductless glands in response mechanism and personality has been discovered through various methods The physiologists remove some particular gland

from the body of the animal and observe the influence of its absence. The chemists analyse different hormones, and prepare them artificially in their laboratory. Some hormones are taken out from the bodies of different animal by killing them. The physicians use these hormones to remove various types of disturbance.

Q. 18. Describe the distinctive functions of the Central Nervous system. *(Bombay 1950; Gujrat 1960)*

Ans. The central nervous system is the most important part of the response mechanism of man. In the whole body of man there is a net work of nerves. This net work presents the general scheme of the central nervous system.

Sensory and Motor Nerves

The nerves of the central nervous system reach every sense organ and muscle. These nerves are connected with the central ganglia of the spinal cord. All the nerves meet at this centre. The nerves carrying the message from the receptors to the centre are known as sensory nerves. The nerves carrying the message from the centre to the muscles are known as motor nerves. The response mechanism works by systematic working of the sensory and the motor nerves. Besides these two types of nerves there are nerves connecting them.

Nerve centres

Thus various responses of the human body function through nerve centres. These nerve centres are very complex. When seen with the help of a microscope, many subtle fibres are seen in other nerves. These fibres are very thin but reach from the receptor to the nerve centre and from the nerve centre to the muscle. Thus some of these are even some yards in length. The complexity o the nerve centre can be imagined from the fact that the optic nerv alone has about 4,00,000 fibres. A nerve is made up of a bund of fibres. These fibres are connected outside the nerve centre, b again meet in the nerve centre. It is not necessary that one fi should carry one message, some times an out going fibre ta several messages. When the nerves are broken and the muscles un-connected with the centres, these fibres become useless.

Axons and Dendrites

The nervous system is made up of nerves. The nervous sy and the nerve cells are connected through the blood vessels. nerves also include their branches. These branches are of

types—Axons and Dendrites. Axon is one and alone while dendrites are many. Axons are several feet long. The dendrites extend like the small branches of a tree. The axon is covered by an insulating substance. The axons of the sensory nerves are sensory while axons of the motor nerves are motor. A motor axon extends from the *brain or spinal cord to the muscle or gland.* The sensory axon extends from the nerve cells to the brain Thus these axons connect the receptors and the nerve centres

Synapse

The connection between the two cells is known as synapse. In this synapse an axon of a nerve finishes in fine branches and these fine branches get connected with the dendrites of some other nerves. Thus a synapse is formed, when the axons of a nerve get connected with the dendrites of another nerve, and a sensation is carried from one to another. The axon carries the sensation and the dendrites receive it Thus the message is communicated from the axon of a nerve to the dendrite of another nerve. This message is in the form of nerve impulse which is like an electro-chemical current found in the nerve The force of the reaction of any muscle depend on the to al number of these electro-chemical current per second As it increases and decreases the reaction of the muscles also increases and decreases simultaneously.

There are two parts of the central nervous system : (A) Spinal *cord and (B) Brain.*

The Spinal Cord

The spinal cord is situated in the back bone of the human structure. It is a white soft substance like a rope Its upper surface is made up of white matter and is thick. There are two types of nerves in the spinal cord (1) sensory or afferent nerves and (2) motor or efferent nerves These nerves connect the receptors and the nerve centres The sensory nerves carry the sensation from the receptor to the nerve centre. The motor nerves carry *the message from the nerve centre to the muscle* The coming and going of the sensation and messages is through the grey substance of the spinal cord 50% of the spinal cord is made of grey substance and the rest of the white substance The pathways of the spinal cord are situated just below the skin In their centres are the cell bodies and the pathways are in *the peripheral portion. In the grey* white matter there are tracts coming up and down In the grey matter there are associative nerves

The spinal cord directs the reflex action. In the reflex action, sensory nerve carries the sensation to the brain and the message m the brain to the motor or efferent nerves. This action is so pid that it takes almost no time. Besides the control of the reflex tivity, the spinal cord links the brain with the external parts of ne body. In it are connected 31 pairs of nerves coming from outside. Every pair has one sensory and one motor nerve. These nerves connect the spinal cord with the external parts of the body. Thus the various functions of the external parts of the body, *e. g.*, the movement of the hands, feet etc., are directed through the spinal cord. It has free control on all the learned activities including writing, reading, cycling, typing, walking, running etc. The brain has not to interfere with these habitual actions.

Besides the spinal cord, another important part of the central nervous system is the brain. The brain is divided into following three parts :

(1) Cerebrum; (2) Cerebellum and (3) Mid Brain or Medulla-oblongata or brain stem.

Cerebrum

The cerebrum is bigger than the cerebellum or the mid brain. Hence it is known as cerebrum or the bigger brain. Beginning from the eye brows, it extends to the middle of the skull. Thus it is the frontal part of the skull. It is the highest part in the brain. In it the arrangment of the white and the grey matter is exactly opposed to that of the spinal cord. Its upper surface is made up of grey matter while the internal part is made up of white matter. As has already been pointed out, in the spinal cord the upper surface is made of white matter while the internal part is made of grey matter. The upper grey part of the cerebrum is known as cortex. In it there are clusters of nerve cells which make the sensory area and the motor area of the brain. The white matter forms the nerve fibres. The grey matter forms the nerve cells.

In the cerebrum there are two hemispheres separated from fissure and are known as the right and the left hemispheres. Mo of the part of the right hemisphere is linked with the left part of th body. Thus between the hemisphere of the cerebrum and the bo there is a crossed relation. On the surface of the cerebrum th are small convolutions or Gyri. The convolutions are separa from each other through the fissures. These fissures go deep the matter of the cerebrum. But the brain is not actually di

into these fissures because under the surface of the brain various parts are connected with each other. In the cerebrum there is a fissure in the centre which is known as central sulcus. It is also known as fissure of Rolando Besides this, there is also a fissure situated horizontally. This fissure is known as fissure of silvious or lateral sulcus.

The big portions of the cerebrum are known as lobes. These lobes are connected with the other. Thus the cerebrum is divided into four parts, given below :—

(1) Frontal. (2) Parietal Lobe; (3) Occipital Lobe; and (4) Temporal Lobe.

All these four parts of the brain are connected by sensory projection fibres. These fibres enter one lobe from another.

These different parts of the cerebrum are connected with different types of sensation. For example, the frontal lobe is connected with thinking In complex thinking, it is this frontal lobe of cerebrum which works. In the central part on the ore side of the central sulcus there is a motor area. This is situated in the frontal lobe In the parietal lobe there is a somaesthetic area where the sensations from the skin and muscles are received. In the upper part of the temporal lobe there is auditory area where the sensations of hearing are received. In the back part of the brain in the parietal lobe there is the visual area where the sensations of seeing are received. Near the lateral sulcus there are areas of taste and smell.

***Q. 19.* What do you understand by reflex action ? Distinguish it from voluntary action.** *(Agra 1961)*

What is Reflex ?

Reflex actions are unlearned responses which happen quickly and by themselves In Woodworth's words, "A reflex is a direct muscular or glandular response to a sensory stimulus, an involuntary and unlearned response. Unlike the simple reaction it does not depend upon the subject's being prepared or set. The reflex does not need a Ready signal" Whenever something approaches the eyes, the eyelids blink. When something tickles the nose, a sneeze is inevitable. The muscles of the hand or foot immediately react if the corresponding organ is pricked by a needle All these are reflex actions They do not have to be learnt because they happen by themselves Generally, they cannot be stopped even with effort. The individual is not even conscious of these

activities when they are taking place. These activities are due to external stimuli. They take place far too fast to be noticed. When anything is taken near the eye, it takes approximately '05 seconds for the blinking action to be performed. If a person sits with the lower part of his legs freely suspended, then when tendon below the bent knee is pressed the tendon knee jerk happens in 03 second. But this does not mean that all reflex actions take place faster than common reactions. For example, the pupil takes one or two seconds to contract, when a strong light focusses on the eyes. Besides the external stimuli, the reflex actions are also activated by internal stimuli. The contraction and expansion of the stomach and intestines and the veins, the colouring of the skin while blushing etc. are all reflex actions of the muscles. The flow of saliva in the mouth on perceiving something edible, the flowing of tears if a grit lands in the eye are reflex actions related to glands. Snatching the hand if it gets burnt, coughing, sneezing etc , are external reflex actions.

Kinds of Reflexes :

Generally there are two types of reflexes :

1. Physiological Reflexes—This classification includes those reflexes of which the individual is not conscious, e. g., the dilation and shrinking of the pupils of the eyes. If strong light is focussed upon the eyes, it naturally contracts and it expands when the light is insufficient. The individual is unconscious of this activity on the part of the eyes.

Uses of the Reflex :

2. Sensation Reflex—As opposed to the physiological reflexes, a person is quite conscious of the activity in a sensation reflex Coughing due to an irritated throat, sneezing because of a tickled nose, watering of the eyes due to the alighting of a grit in them are all activities of which the person has full knowledge.

Though undesired, uncontrolled and unacquired the reflex action is useful for the body of which it is a natural reaction. It protects the various parts of the body from external objects as blinking of the eye protects it from the approaching fingure. The reflex satisfies needs of the individual and many activities are carried out which are necessary for the body. For example, the sucking of the milk from the mother's breast is a reflex action of the child because he does not have to learn the activity of sucking.

The importance of reflex activity in a human being's life is also evident by the fact that all the reflexes do not take place simultaneously and appear at different stages in the person's development. As the person's nervous system matures, different reflexes appear at different times. The reflexes of sneezing and coughing make their appearance very quickly after birth but the reflex of blinking takes some 11 weeks after birth to appear. Sex reflexes appear after the age of ten. The activity of reproduction develops naturally because of this. As these reflexes take place without disturbing the attention of the individual, he can look to other things at the time these reflexes are happening The needs of the new born baby are fulfilled by these reflexes while he does not learn to satify them.

In brief the peculiarities of the reflex are :

Peculiarities of Reflex

1. All the reflexes do not appear at the same time but at different stages in the development of the organism.
2. Reflexes are useful for the body.
3. It is difficult to control the reflexes as most of them are unconscious.
4. Reflexes are immediate
5. Only one reflex corresponds to one stimulus *e.* g , blinking the eyes is due to strong light.
6. These reflexes are not learnt but innate.
7. Reflexes are simple and limited to a particular area. Their reaction to an excitement is in some particular part of the body.

Difference between Voluntary and Reflex Actions

The specialities of the reflex actions mentioned above make apparent the differences between them and voluntary actions, Fundamentally, they are as follows .

1. Reflexes are uncontrolled while the voluntary actions are under full control It is easier to stop running than to stop the eye blinking.
2. When compared to voluntary, the reflex actions are immediate, because they do not need contemplation or decision Voluntary actions may take place a long time after the stimulus
3 Only one reflex results from one stimulus but there may be many voluntary actions as a result of the stimulus. Bri[illegible] it will only cause a blinking of the eyes but almost any oth[illegible] like trembling, running falling may ensue
4. While the reflex actions are innate and , una[illegible] voluntary actions like running, walking etc , are learn[illegible]

5. Reflexes are simple but the voluntary actions may be complex. The reflexes are limited while the whole body may partake of a voluntary activity.

Q. 20. **What do you understand by cerebral localisation? Explain.** *(Osmania 1963)*

Phrenology :

Ans. The study of the localisation of brain functions has its own story in the history of psychology. The problem of localisation is whether different areas of the brain activate different functions or not. This discussion was started in 1800 by the theory of phrenology advanced by the famous anatomist Gall. Gall tried to relate the external elevations in the skull to mental specialities or peculiarities. He said that these elevations indicated mental peculiarities. According to the theory of phrenology, mental faculties are situated behind the forehead in the forefront of the brain. Thus middle brain constitutes the residence of the ethical qualities while the rear end is for the animal tendencies. The sex instinct is in the medulla oblongata while the quality of faith finds itself in the stem.

Experiments of Flourens :

In 1825 or therabouts, Flourens concluded from his experiments that the cerebrum worked as a unit. Thus he refuted the localisation of the various functions in the brain and challenged, against the theory of phrenology, that the cerebrum works as a whole. Thus, some one hundred year from today it was believed that one part of cerebrum could not be distinguished from another. The cerebrum is a collection of many parts which can perform many activities but each part of which is capable of performing every one of those activities.

Proofs of Localisation :

This theory advocated by Flourens was credited till 1860. After this, Paul Broca showed that when a particular area of the cortex was injured, a difficulty in speech was experienced. After Broca's experiments, Frish and Hitzing found that electrical sensation in specific parts of the cortex caused motion in various parts of the body. These experiments high lighted the theory of localisation for the second time. The expert physiologists supported the notion because they found substantial difference in the structure of the various parts of the brain. Surgeons also supported the theory of localisation because they wanted to explain the different physiolo-

gical changes caused by injury to differnt parts of the brain. Thus fifty years ago, the theory of different centres for different activities, in the brain of course, was being supported and these centres were being further subdivided. Psychiatrists were establishing relation between specific mental illnesses and the conditions of specific parts of the *brain*.

Current Situation :

But now the emphasis laid in favour of localisation is losing its strength. Some localisation of function and structure in the cortex is still believed but great care is taken before a certain area is pronounced as the centre of a specific type of activity. The cerebrum is popularly believed to be an adjustor part It is understood that its function is not to perform diversified and unrelated activities but to direct the creature to mould its behaviour in conformity with the environment. Many experiments have definitely proved that information of different kinds of changes reaches different areas of the cortex. The existence of somaesthetic area, premotor area, auditory area and visual area and different centres has been indicated by experimental administration of electrical sensations to various parts of the brain *Thus, this kind* of cortical localisation is no longer in doubt.

The boundaries of different activities however, cannot be decided by having them centred in the cortex. For example we accept one somaesthetic or sensation area but in 1916. Dusser de Barenne showed at Oxford that inspite of the localisation of a sensation area, it extends over a large area of the cortex and its boundries are not established. From this it is concluded, that though the area of reception and projection of sensations may be localised, the localisation of areas for converting sensation signals into sensations is not possible. The direct paths of the entrance of visual sensations to the cortex of the brain can also be determined but they cannot be accepted to be completely unrelated to the areas surrounding them. The signals received in the motor area do not convey any thing and any *knowledge is due to shock or injury In fact* the first attempts at localisation were made in the direction of the motor area, but as the experiment at Oxford proved, there is a lot of scope in this direction Nothing deflnite can be said whether the area for the assimilation of information from different organs of the body is definite or not Nothing definite can be said about the location of mental function or the limits of their areas and

centres. Further research in the future may make it possible to say something with authority upon the subject.

Methods for the Study of Localisation

Many methods are employed for the discovery of localisation of different activities in the brain. The major methods are as follows :—

1. *Method of Electrical Stimulation*—The exposed part of the cortex is subject to weak electrical stimulation and the resulting motion in the body serves the purpose of establishing the relation of the specific activity to a specific area in the brain. The method of the study of localisation is the most famous.

2. *Pathological Method*—The disturbed activities and behaviour of a diseased person are noted following which the person is cured by the surgical or otherwise removal of the diseased part of the brain. The effects are again observed.

3. *Method of Extirpation*—Some part of the brain is removed and the effects on the behaviour and physiological activities are observed. The area which is extracted is taken to be the centre of those activities or functions which either become absent or are affected in any way. These experiments are usually carried out on animals.

4. *Fibre Tracing Method*—This method traces the fibre which connects the cortex to the lower centres and finds the relation of the various parts of the body to some specific areas in the cortex. Though the method is satisfactory the tracing of fibres is no easy task.

When the above methods succeed in localising a particular activity in the brain, the research is credited and accepted in the absence of any evidence to the contrary. These methods are employed in the location of functional areas in the brain.

Localisation of Combining Areas

Besides these functional areas there are two sizable combining areas, one of which is situated in the midst of many sensation areas in the parietal, temporal and occipital lobes, while the other is found in the motor area and in front of the frontal lobes. The knowledge of the localisation of these areas originates from any injury to the brain. The result of these injuries is manifested in the form of Aphasia, Agnosia and Apraxia, and they are the ones to establish the localisation. Thus it will be in keeping with the subject to make a brief description of them.

1. Aphasia—In this illness, speech and language cannot be used or used with difficulty. A connected and meaningful, comprehensible sentence cannot be spoken and neither can the meaning of such a sentence be undersood. The cause of this difficulty is not paralysis but rather injury to the area surrounding the auditary area.

There are two kinds of aphasia—speech aphasia and motor aphasia. In the latter kinds, the difficulty lies in emitting or ejecting words from the mouth and the difficulty, too, takes various forms. Some patients can pronounce separate words but not sentences, even when written. Other patient's capabilities extend to the pronounciation of simple words like yes and no only. The lower motor area is usually injured

2. Agnosia—The ability of perception is undermined in agnosia. The person hears and sees all right but he cannot utilise the sensory data in the form of specific, concrete signals. In visual agnosia, the result of injury to the occipital lobe, the person loses his ability to recognise and distinguish colour and form. He cannot recognise sounds If the injury is just behind the somaesthetic area, the patient cannot recognise an object placed on his hand and neither can he, on the other hand, metaphorically speaking, make any guesses about its weight

3 Apraxia—The ability of work or effort is adversely affected. An apraxia patient cannot light a cigar and smoke it. He can perform singular activities but the relating of many activities is beyond his capabilities. Generally, the appearance of apraxia is the *consequence of injury to an area in the vicinity of the motor area.*

Intelligent behaviour is absent in aphasia, agnosia and apraxia. Symbols and skilled efforts are of great importance in intelligent behaviour and skilled efforts or motor activities depend on specific areas of the cortex which, if injured loses the combination of these parts The loss of this combination and the loss of intelligent behaviour in the individual both are determined by the extent of the injury.

Type of combination in the brain

The work of combination in the brain is effected in two ways—

1. Internal Combination—In this, the stimuli are many while the activity is solitary This combination finds expression in the unitary response to an object For example, when we see a film, a stream of various stimuli falls on the retina with the result that we see an undivided scene. Similarly, though the noise enters the

ear in a succession of sounds it is heard as music in the combined form. Thus, in internal combination there is a type of collective activity which necessitates specific nervous behaviour. Possibly, the area for the collective internal combination is the adjustor area of the posterior end, located in the midst of various sensation areas.

2. *External Combination*—Many results are caused by a unitary antecedent. For example you have to get up from the chair, go to the door, turn the key in the lock, remove the bolt etc., in order to open the door. A distribution mechanism is needed for this. It is formed by the branches of an axon and the stimulating of many nerve cells by these branches. The area for the distributive external combination is quite possibly the front part of the brain.

Localisation of combining Activity

Undisputed evidence has not been found on the subject of the brain taking part in these combining functions. In fact, a large part of the brain takes part in these combining functions a fact mentioned once before. Thus it is difficult to localise it. There are many activities like learning or memorising of which the whole cortex partakes. In an experiment it was seen that a monkey forgot all learned actions when the frontal lobes were removed from the brain, but learnt it when taught again. Many experiments along these same lines made it apparent that different parts of the cerebrum assist in the learning of an action. Thus the diminution in the ability of learning depends upon the percentage of the cortex removed. The difficulty in learning and the disturbance or disorganisation of activity depends upon the corresponding damage to the cortex.

Conclusion :

The above treatise on the localisation of brain functions makes it clear that the localisation of the areas of various functions is accepted now a days. But the boundaries of these areas are as yet undefined and nothing can be said definitely about them. No indisputable statement can be made on the subject of localisation of the combining areas. Many activities are incapable of being localised because of their dependence on the whole cortex. The truth of the matter is that this problem of localisation is still in the experimental stage and more experiments must be carried out before any authoritative statements can be issued. Future experimentation will be the basis on which any conclusions will be founded. But till then, it can be believed that there are specific areas for dissimilar activities whose boundaries are not demarcated.

5

Individual Differences

Q. 21. What do you understand by individual differences? Discuss in detail

Meaning of individual differences:

According to Skinner, "Today we think of individual differences as including any measurable aspect of the total personality." From this definition of individual differences it is evident that it comprehends every aspect of the human personality, albeit all aspects that are in some manner measurable. Aspects of this nature can be many such as variability, conformity, difference in the rate of learning and development, mutual relationship between *the various characteristics of the personality, etc. In this manner,* various individuals exhibit differences of physical and mental development, nature, rate of learning, ability, specific abilities, interest and personality, etc

Types of individual differences:

(1) Average intelligence—The following brief description may serve to make individual differences a simple concept that can easily be grasped Individuals are seen differing in considerable measure in respect of their general intelligence. It is not possible to send children with an intelligence quotient of below 50 to schools Children with a higher intelligence quotient go to school. Children with intelligence quotients between 50 and 70 can learn only the simplest tasks. Even the small schools trouble children whose intelligence quotient varies between 70 and 80 Children between *75 and 90 I Q are considered morons, and they have considerable* difficulty in progressing, along with the other children, in their learning. Generally, 40 to 60 percent of the children in school have I. Q s varying between 95 and 105, being the children with average intelligence who form the basis for the formulation of the syllabus and curriculum as well as the method of teaching. Children who are either above or below this level of intelligence require special

educational methods and conditions. Children with intelligence quotients varying between 115 and 120 are considered brilliant or intelligent. The following facts have come to light concerning individual differences of intelligence in children :—

(a) However good and beneficial the environment and the method of education, the moron invarialy reaches his highest level of learning before the average or the intelligent child.

(b) In favourable circumstances the average child generally gives a good account of himself in his academic pursuits.

(c) If the circumstances are favourable, the intelligent child shows great alacrity in the process of learning.

(d) Adverse circumstances have the worst effect on all children, and their learning activities are hindered.

(2) **Special abilities**—During the junior and senior high school as well as the college stage, the individual's differences in respect of special abilities, in addition to the general intelligence, are also important since special professions and specialised fields of vocation all need certain specific abilities. Abilities of this kind are concerned with mental personality or motor ability.

(3) **Differences of Background**—In school, the differences that the children exhibit are the outcome of their different families and their communities. Attitudes towards education and authority differ in each family, culture and class. Some of these attitudes are favourable while others are unfavourable to education. In either condition the difference of attitudes results in differences among children. Besides these attitudes, the child's emotional, social, aesthetic and moral development is influenced by his family and the neighbourhood. Hence differences of background are also manifest in individual differences.

(4) **Alacrity in learning**—Difference in the quickness or alacrity in learning is visible not only in children of different ages but also among children in the same age group. This difference is dependent upon their maturity and educational background. Differences in the alacrity of learning result in benefits accruing from formal education.

(5) **Mental age**—Children of differing ages as well as children of the same age show differences in their respective mental ages. Generally speaking, all students studying in the same class differ according to their mental ages. It has been observed that in the age of 6, differences in mental age range up to 5 years. Mental age and education are intimately related. The child's level of education is determined according to his mental age.

(6) **Motor ability**—The individual's movements of the hand and feet and other physical abilities are seen to be very individual, as they do not resemble another's to any great extent. Till the individual attains adulthood, his manual dexterity, rate of muscular movement and resistance to fatigue develops continually. In this manner, the same individual in different ages and different individuals in the same age group manifest considerable differences in manual dexterity.

(7) **Sex differences**—Maknemer and Terman discovered the following differences between men and women, on the basis of some studies—

(a) Women have greater skill in memory while men have greater motor ability.

(b) Female handwriting is superior while men excel in mathematical logic.

(c) Women show greater skill in making sensory distinctions of taste, touch, smell, etc., while men show greater reaction and consciousness of size-weight illusion.

(d) Possessing greater linguistic ability women are superior to men in languages, similitudes, word building, compositions, and use of long sentences, etc. On the other hand, men are superior in physics and chemistry

(e) Women are better than men is mirror drawing Faults of speech etc, in men were found to be three times of such faults in women.

(f) Women are more susceptible to suggestion while there are three times as many colour blind men as there are women

(g) Young girls take interest in stories of love, fairy tales, stories of the school and home and day-dreaming, and show various levels in their play On the other hand, boys take interest in stories of bravery, science, war and scouting, stories of games and sports, scouts stories and games of occupation and skill.

8. **Racial differences**—Many scientific studies have indicated the presence of various kinds of differences between individuals of different races, although differences of environment are a normal factor in causing these differences Karl Brigham has composed a list on the basis of differences in levels of intelligence among people who have migrated to United States from other countries.

On the basis of these average differences between the races,

the mental age of a particular individual of a definite race cannot be calculated since this difference is based on environment.

9. **Nationality**—Many studies have led to the conclusion that individuals of different nations differ in respect of nature, physical and mental differences, interest and personality, etc. Such a difference is anly natural since their cultural and geographic environment is distinctive.

10. **Economic situation**—Economic differences are seen causing differences in the children's interests, tendencies and character, etc.

11. **Differences relating to learning**—In respect of learning, children manifest such differences as past experience and learning, ability in the use of various kinds of apparatus, rate of learning, interest in learning, etc.

12. **Difference in respect of development**—Difference in development is in evidence not only in individuals of different age groups but also between individuals of the same age.

13. **Difference of interests**—As has been pointed out, the difference in sex leads to a difference in interests. Similarly, factors such as family background, level of development, differences of nationality and race, etc., cause difference of interests.

14. **Personality**—Differences in respect of personality have led psychologists to much study, and on the basis of this study individuals have been classified into many groups. Jung, for example, has divided individuals into three groups—(a) Introvert, (b) Extrovert, and (c) Ambivert This is the psychological classification of people. Stephenson has divided human beings into two categories—preservator and non preservator. In this division. people of the first group are very sensitive and susceptible to experience while people of the second group are not influenced by it to quite that extent. Cattel has put people into the Surgent and the Surgeless or Non surgent classes. The former is similar to Jung's extrovert while the surgeless resembles his introvert individual. Terman has put people into 9 classes according to their level of intelligence—(a) Genius, (b) Near Genius, (c) Very superior intelligence, (d) Superior, (e) Average, (f) Backward, (g) Feeble-minded, (h) Dull, (i) Idiot

Thorndike has divided people into four categories on the basis of thinking—(a) Abstract thinkers, (b) Ideational thinkers, (c) Object thinkers, (d) thinkers in whom sensory experience is

predominant. These names indicate the peculiarities of thinking in these individuals.

From the viewpoint of nature, personality has been divided into three classes—(a) thought dominant, (b) emotion dominant, (c) *action dominant*.

Concerning these classifications of the human personality, it should be remembered that although one specific person may exhibit the main broad characteristics of one class of personality, he cannot be said to belong to only that class of personality as the differences between various personalities are so subtle and minute that it is not scientificially feasible to divide them into classes.

6

Sensations and Weber-Fechner Function

Q. 22. What is the nature of sensation ? What are its attributes ? *(Bombay 1959, Karnatak 66, 65,*

What is sensation ? Illustrate its types, corresponding receptor organs and stimulus objects. *(Baroda 1964)*

State fully the various characteristics of sensation. State also what you understand by local sign. *(Delhi 1957)*

Ans. Sensation is the first response of the organism to the stimuli. Its nature is clear from the following points :

1. Comparatively passive state—Sensations are not voluntary in the sense that we cannot produce them at will. They do not depend on our choice. They are, on the other hand, forced upon us by the environment. The sense organs passively receive sensation. Thus sensation is a comparatively passive state of consciousness. This is amply clear by its comparison with perception.

2. Partly subjective and partly objective Sensations form a part of individual's personal experience. Thus they are subjective to that extent. On the other hand, they are also objective as they are answered by an external stimulus. Thus sensation is partly subjective and partly objective.

3. Distinction of Quality -Sensations differ in quality. For example a sensation of sound differs from a sensation of colour in quality. Different sensations differ in quality.

4 *Distinction of Quantity* – Sensations differ in quantity regarding intensity, duration and extensity An example of the difference in quantity due to intensity is the difference between the loud sound of thunder and the soft sound of whisper Duration depends on the persistance of the stimuli As the persistance differs so the duration and with it the quantity of the sensation. Extensity *i.e.*, voluminousness depends upon the sensitive surface attended. As the affected surface increases so does the extensity thereby making a difference in the quantity of different sensations.

5. *Relativity*—Hoffding points out to relativity among sensations. A sensation is relative in three senses Firstly, it is relative to other sensations is so far as its arousal depends on its contrast with other sensations. Secondly, as Weber's experiments have amply demonstrated, the quality of the sensation is also relative to other sensations For example if one handles ice first and then water, water will appear more hot than it does normally. Thirdly, the increase and decrease in sensation due to corresponding increase and decrease in stimuli is also relative to foregoing sensation. Thus Hoffding has rightly said, "From the moment of its first coming into being, the existence and properties of a sensation are determined by its relation to other sensations".

6. *Distinction in traits*—Different sensations have different traits. For example the organic, spatial and motor sensations have different characteristics distinguishing them from each other.

7. *Special sensations are distinguishable*—Special sensations are localized in the external world They can be easily distinguished from each other

Attributes of Sensations

Sensations have different attributes The main attributes have been classified into :

1. Quality
2. Intensity
3. Duration
4. Extensity
5. Local sign

1. *Quality*—Sensations differ in quality Each sensation has its own quality Sensations received through different sense organs differ in quality Again, sensations received through the same sense organ also differ in quality. Different types of colour and taste exemplify this fact.

2. *Intensity*—Different sensations have got different degree of strength or intensity The intensity of a sensation depends upon (a) the objective strength of the stimulus, (b) the mental state of the individual

3. *Duration*—The duration of a sensation depends on the continuity of the stimulus or of its effect As this varies with different sensations their duration also varies

4. *Extensity*—Extensity meaning voluminousness or spreadoutness of sensation is a spatial characteristic As this increases

ensation appears to be bigger. For example, the touch of a is more extensive than the touch of fingers.

5. *Local sign*—Different sensations are distinguished according to the spot stimulated. This is local sign. It is because of erent local signs that one can distinguish among the sensations, ving the same quality and same intensity, duration and extensity. ius one can distinguish between two pin pricks simply because ey are felt as two.

Q. 23. What are the main kinds of sensation ? Define sensation. *(Gujrat 1955)*

Write short notes on Organic sensations.

Explain briefly the different kinds of sensation. *(Punjab 1963, Gujrat 58)*

Types of Sensation :

Sensation is the first response of the organism to the stimulus and is a step in the direction of perception. In practice, sensation is not separated from perception. This distinction is necessary in order to facilitate study. Ward expressed it thus : "Pure sensation is a psychological myth". Sensation is felt through the sense organs. We receive sensations through the eye, nose, tongue, skin and ear popularly known as the five sense organs. Apparently, there are many types of sensation but they can be divided generally in the following three categories :

(1) Organic sensations. (2) Special sensations. (3) Motor sensations. Special sensations correspond to the five sense organs *e. g.*, visual sensation, auditory, olfactory and tactual sensations and sensations of taste.

Organic Sensations :

The sensations which arise from the conditions of the internal organs are known as organic sensations. They do not need any external stimulation. Hunger creates organic sensation caused by the contraction of the walls of the stomach. Similarly, thirst creates organic sensation which results from the drying up of a membrane located at the back of the neck. Obviously, these sensations indicate the internal conditions of the body and do not convey any knowledge of the outside world.

The organic sensations are of three types, this distinction being based on their location. They are :

1. Sensations whose location can de determined—Some orga nic sensations can be easily located. The experience of cuttin burning, blistering etc., is in the tissue Its location is fixed.

2. *Sensations whose location is undetermined*—The position of some sensations cannot be determined. The position of comfort and restlessness are spread over the entire body and no particular part of the body can be assigned to them.

3. *Sensations whose location is vague*—Apart from the organic sensations, mentioned above, there are some more sensations about whose location we have a vague notion. We have a hazy idea of the general location of some sensations, like hunger, thirst, pain, though we do not know the exact location minutely.

Organic sensations are of considerable importance due to the role which they play in the Affective and Motivational aspects of life. Hunger and thirst make us restive and compel us to search for food and water.

Special Sensations

It has already been mentioned before that the special sensations are those which are caused by the specific sense organs eyes, nose, ears, tongue and skin These special sensations can be clearly distinguished from one another. They originate from external stimuli like the waves of ether, to mention only one.

Differences between organic and special sensations

There are the following differences between organic and special sensations :

1. The source of special sensations is external stimuli while the source of organic sensations is internal.

2. There are specific organs for special sensations while there is no such provision for the organic sensations.

3. The special sensations give knowledge of the outside world, which the organic sensations do not.

4. The special sensations can be recollected with ease, but the organic sensations cannot be retained easily

5. The special sensations can be distinguished clearly from each other. This is not the case with organic sensations.

6. It is possible to locate the special sensations while, in most cases, the location of organic sensations is not possible

7. Special sensations are comparatively more intense in quality and quantity than the organic and motor sensations. The five special sensations may have many internal sub-divisions.

The exposition upon the differences between organic and special sensations makes obvious the distinctive characteristics of

the later. The five special sensations are the following :—

1. *Visual sensations*—Visual sensations, which are stimulated by light waves are experienced through the medium of the eyes. They are of two types—(i) Sensations of Brightness, (ii) Sensations of colour, of which the following four are primary—red, yellow, green and blue. Colour blind people do not feel these sensations.

2. *Auditory sensations*—These are received through the ears. They are the reactions of the ear to the vibrations in the air. Usually, the local symbol is absent in auditory sensations in which the power of discrimination is high. These sensations are important from the emotional view point.

3. *Taste sensations*—It is the tongue which acquires these sensations. There are many papillae in the tongue. Mostly, there are taste pores in these papillae. There are bag-like structures called taste buds below taste pores, and they contain 10 or 12 taste cells. These taste cells are also the taste receptors. The sensation of taste passes through the tase pores and reaches the taste bud, whence the sensation is transferred to the brain. The result is the experience of taste. The central portion of the tongue cannot receive sensations of different tastes. The tip of the tongue acquires the sweet taste, the rear the bitter taste, the edges the sour taste, while the saline taste is spread uniformly all over the tongue.

4. *Olfactory sensations*—Receptor cells for the olfactory sensations are located in the nose at its apex. As only a part of the breath reaches them, it is necessary to draw a deeper breath in order to smell the odour. The odour carrying air, which is drawn in, activates these cells by touching them. The sensation is carried to the brain and odour is perceived.

5. *Tactual sensations*—The skin contains the receivers of somaesthetic sensations. There are two types of sensation, included in somaesthetic sansations—cutaneous and kinaesthetic. Cutaneous sensations include the sensations of pressure, warmth, cold and pain. There are different areas for these sensations, interspersed with insensitive areas. The other type of sensations, kinaesthetic sensations, are felt in muscles, bones and various nervous joints and their covering membrane. These are related to the receivers. There are four types of cutaneous sensations *viz.* pressure, warmth, cold and pain. They are different from each other and they have different areas of the body assigned to them.

Kinaesthetic sensation.

As is obvious from their name, these are the sensations related *to motion. Tension, contraction, pulling etc.*, are examples of motor sensations. They are caused by the muscles, tendons and joints. The nerves embedded in these give the sensations of motion when the muscles contract or the joints move. The brain receives information of these sensations through the sensory nerves whose fore parts are in the muscles, tendons and joints. The motor sensations put pressure upon the skin.

Kinds of Motor Sensations :

1. Sensations of Position—Such a sensation is generated when the arms are held motionless in a fully extended position.

2. Sensation of free Movement—If the arms are moved in all the directions, then the arising sensations are those of free movement

3. Sensations of Impedded Movement—These can be experienced by lifting some heavy weight.

Importance of Motor Sensations .

Motor sensations are a means of the knowledge of the primary qualities of objects e.g , their position, distance, direction, weight, etc. These sensations take place automatically and generally pass by unnoticed. They become conspicuous by their absence, if such a contingency is created by some defect in the body.

Q 24. Describe the structure of the eye and explain how colour vision arises *(Madras 1962, Poona 1966, Karnatak 1965; Ravishanker 1965)*

Visual Receptor :

The physical sensations of light from the environment are collected by the visual receiver cells located in the eyes The eyes are connected to the Diencephalon which is in turn, related through the occipital lobes to the cerebral cortex.

Structure of the eye .

Observed from the outside, there appears to be an eye ball in each eye. There is an external covering whose fibres are rather tough and white. It is called the selerotic coat It protects the internal parts of the eye and preserves its shape. The foremost part of this coat is transparent and is called the Cornea. Below these there is another coat, called the Choroid coat. It is more of a network of blood capillaries than anything else In the gap between the external covering and the lens, there is a coloured muscle called the Iris This assimilates the light falling upon the lens. The lens is the transparent cornea.

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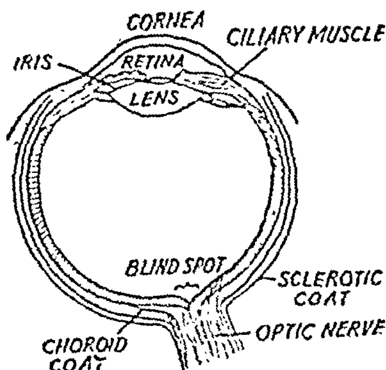
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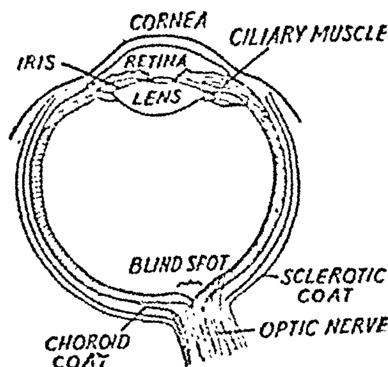
The ciliary muscle accommodates the second lens, which is behind the retina. The eye focusses objects at various distance with the help of the ciliary muscles. The retina is a thin membrane stretched over the central part of the eye. It contains the sensory cells which are connected to the brain by means of the nerves. The space between the cornea and the lens and the retina is filled with a fluid which helps to keep the eye healthy. There are seven layers in the retina which contain various types of cells. They are linked to the Optic Nerve. The sensation of vision is caused by the light falling on the retina. On the retina there is a spot called the Fovea which is identical with the Iris. The vision is clearest when the light falls on the spot. This place where the optic nerves meet the eye is known as the *Blind Spot*.

Though the object is visible here its shape is distorted. The given diagram illustrates the various parts described above.

Visual Receptor cells :

Having understood the structure of the eye, it will be easy to understand the visual receptor cells. This understanding will bring with it a knowledge of the process of seeing. The retina has two types of sense cells : Cones and Rods.

1. Cones : These, located in the yellow and blue areas exclusively, number something like 70,00,000, in the entire retina. They are concentrated near the Fovea. As the distance from the Fovea increases they grow less and become out numbered by the Rods. These cones are indispensable for colour vision and a person becomes colour blind if either they, or their sensory nerves sensitivity decreases with the intensity of light.



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2. *Rods*: These sense cells assist in vision when the light is dim because their sensitivity increases with the decrease in the intensity of light. Being colourless, they work when the cones do not and that is when object is colourless. The change over to rod vision due to the fall in light intensity is called Purkinge-Phenomenon.

How do we see ?

In seeing, light reaches the eye with the help of electromagnetic waves. The sensation of light depends upon the wave length, purity and amplitude of the wave. The purity of the waves affects the saturation, the length affects the hue and the amplitude affects the brightness of the visual sensation All the parts of the retina do not absorb colours and the areas which do absorb colours are divided into different parts for the different colours.

The eye ball is rotated in the socket by six muscles. There is an adjustment between the motion of the eyes. The retina adjusts the light while the distance of the object is compensated for by the motion of the eye ball. Thus, these two separate adjustments make it possible for us to see objects at varying distances.

Q 25 **Make a diagram showing the tympanic membrane, the ossicles, the semicircular canals and *the cochelea in the apparatus of the ear and name the particular functions of each of these parts***
(Gorakhpur 1962)

Give an account of Auditory sensations and their stimuli. How can we locate the source of sound ? *(Punjab 1966)*

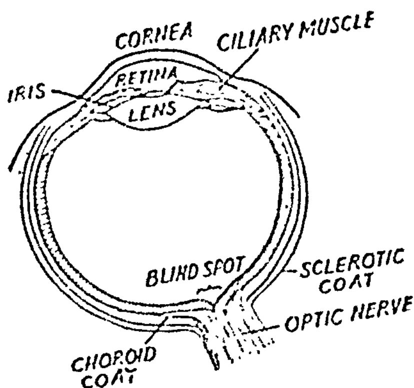
Describe the attributes of auditory experience Show how they are dependent on stimulus characteristics *(Poona 1963)*

Ans The ear is a mechanical receptor of sensations which are of a mechanical nature The ear with which we hear has three parts :—

1. External Ear: This includes all that we can see from the outside, even the opening The thin membrane, the eardrum separates the external ear from the middle ear

2. Middle Ear There are three small bones in the Ear ossicles, which are called the Hammer, Anvil and Stirrup, respectively, so termed because of their shape and function. The hammer *and anvil work like a hammer and* anvil respectively, while the part known as the stirrup is shaped like a stirrup. The middle ear is linked with the throat through the Eustachian tube.

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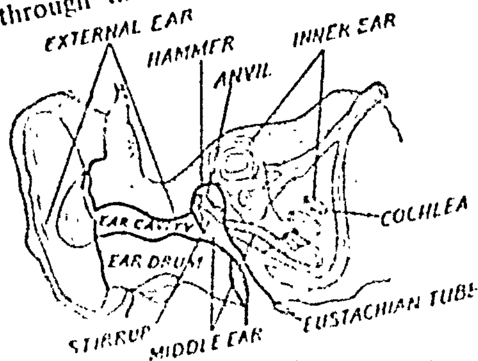
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acant space surrounding these parts is filled with fluid called Perilymph. At one end of the vestibule there is an elliptical opening covered by a membrane connected with the stirrup of the middle ear. The tube of the cochlea is connected with the vestibule. This cochlea tube is filled with another kind of fluid, closely related to the act of hearing. In the cochlea, there is an organ called the organ of corti, which is placed on the internal membrane. There are hair cells in the organ of Corti, which are connected to the auditory nerve fibres. The semicircular canals are meant more for the balance of the body than for hearing.

How do we hear ?

The act of hearing involves all the parts of the ear which have been elaborately described above. The first step is the vibration of the tympanic membrane of the external ear. The hammer is put in motion as a result of this disturbance, and the motion is transmitted through the anvil to the stirrup. The agitation passes through the elliptical opening and puts pressure on the fluid in the internal ear. By the time it reaches this point the pressure of the sound wave is magnified 30 times. The pressure on the liquid actuates some local action and disturbs the Hair Cells in the cochlea.

After the necessary analysis, the sensation reaches the pariatal lobes by passing through the auditory nerves. The external ear



Ear

contains a wax-like substance whose function is to prote tympanic membrane from high frequency sound waves.

Q 26. Write a short note on—Colour Blindness. (*Punja*

What is colour blindness

As a general rule every person can recognise yellow, red, green etc. and can distinguish them. But t ceptions to this rule. Some people can neither reco

distinguish colours This effect of the eyes is known as colour *blindness*, and a person suffering from it is called colour blind. A person may either be born colour blind or he may develop it later on.

Types of Colour blindness

Commonly, colour blindness is of three types :

1. Red green colour blindness. As a result of the disease the sufferer is incapable of seeing either the red or green colours. Statistical details show that there is only one woman patient in a thousand while the percentage in the males is 5'5 to 4. This type of colour blindness is innate.

2. Blue-yellow colour blindness : This disease is comparatively rarer. It is generally believed to develop in life rather than hereditary as it is not seen at birth, though, nothing definite can be said about it at this stage.

3. Total colour blindness : As is obvious from its very name, the individual is sensitive to sensations of any colour at all. He sees things in whites, blacks on dull greys. This is rod vision, free from the sensations of any of the colours of the rainbow.

Q. 27. What is Weber-Fechner law ? Does it hold good for all ranges of stimuli ? *(Kolhapur 1965, Poona 1965)*

Distinguish between absolute and differential threshold. Explain and illustrate Weber's law in this connection. *(Ravishankar 1965)*

Describe in detail the procedure followed in the method of constant stimuli for obtaining differential limen. *(Baroda 1965)*

Importance of Weber

Experimental method has the credit of bringing psychology to the scientific level It is experimental psychology which is the solid foundation for psychological principles. In the development of experimental psychology E.H. Weber of Germany can be accepted as the founder Weber was interested mainly in the physical structure of sense organs He did detailed experiments on the sensations of eyes, nose, ears and skin Many scientists of Germany and other countries have experimented widely in these fields but Weber for the first time found out new facts by the experimental method and from them arrived at psychological conclusions Till his death in 1820, Weber remained professor of physiology at Leipzig University in Germany. His experiments and publications gave great encouragement to research work in the fields of medicine, zoology and physiology. Till now physiology is a part of medicine

EXPERIMENTS BY WEBER

From the view of the history of psychology, the most important contribution of Weber is the principle which later on became famous as the Weber-Fechner Law. Before discussing this law it will be appropriate to survey Weber's experiments on different sensations.

To know the effect of temperature on the skin Weber performed a simple experiment. He examined, by successively putting his hand in cold and hot water that the sensations of temperature depend not on the temperature of objects but on the temperature of the skin. The temperature of skin increases by putting the hand in hot water and consequently we feel hot. We feel cold by putting the hand in cold water due to the decrease in temperature of the skin and not due to the coldness of water. This principle also supports the simple experience that the skin of a person feels less warmth or cold when he becomes used to winter or summer. By bathing in cold water in winter we feel less cold. Here we have to keep in mind that the more intense this experience of the temperature of the skin, the greater will be the experience of heat or cold.

For example by coming to a warm place from a cold one, we feel more heat. On the other hand if temperature is changed very slowly then probably cold or warmth will not be felt beause skin gradually acclimatizes with the temperature and becomes used to it.

Experiments Concerning Smell

Weber tried to find out about sensations related to smell and whether gas or liquid has more effect on it. To see this he dropped a 10% solution of eudicologne on the outer membrane inside the nose and by shaking the head established contact between membrane and solution. By the contact of liquid and membrane he experienced no smell. From this he concluded that the liquid is not a powerful stimulus for the sansations of smell.

Weber also experimented on sensations related to hearing. He experimented by bringing two alarm clocks near his ears and then by bringing both the clocks near one of his ears. He found that when the clocks are brought near the ears then the sensations are not equal while when both are brought near one ear then both seem to be sound at the same time.

Experiments Concerning Vision

Weber also experimented on sensations related to vision. He wanted to see the difference between two lines that should exist so

that it is seen. While experimenting on this he saw that a 101 mm. long line seems to be longer than a line 100 m.m. long witn great difficulty and a line 51 m m. long seems longer than a line 50 5 m m. long with great difficulty. Weber saw by his other experiments that when two lines are very close to each other then both seem to be the same. When the difference between them increases then they seem to be different lines. Weber found out the minimum difference between the two lines that should exist so that they may be seen to be different from each other.

Experiments on Doubleness

In relation to cutaneous sensations Weber did research work on the perception of doubleness. He kept a compass on the skin at various distances so that there may be difference between the two points of the compass touching the skin. The precaution was taken that eyes were not used Now it had to be found without the use of eyes that what difference between the two points should exist so that they may be seen to be two. It was seen in these experiments that in the early stages clear difference between the two points was not perceived by the subject but gradually when the difference between the two points was increased then a time came when they could be perceived as two different points of the sensation. From this Weber reached the conclusion that to establish the sensation of doubleness of the points a definite threshold had to be crossed. It must be kept in mind that even before Weber the idea of limen was in use in the measurement of sensations but Weber for the first time used this idea in an organised form. By performing another experiment on tactile sensations Weber saw that the difference between the two points required for perception of doubleness are not similar at various points of the body For example, very little difference is needed for the sensation of doubleness on the fingers and the tip of the tongue. The difference gradually increases on the lips, palms, wrists and shoulders. Weber found out difference in various persons in the experiments related to the skin. For the sensation of doubleness different differences in the points of the compass were required for different individuals. Of the difference with which the sensation of doubleness occurs in one individual, there is no sensation of doubleness with that difference in other persons Decrease or increase of difference among points is needed due to individual difference. To define this fact of individual difference Weber presented the theory of sensation cycle. According to this different persons have different sensations In these sensation cycles doubl—

...does not appear due to excitement. But this theory of Weber ...d not be proved by experiments because it was seen that these ...es get smaller by practice. In other words, a change occurs in ...necessary difference for a sensation of doubleness.

...periments concerning Muscles

The most important of Weber's experiments is concerned with ...he sensations of the muscle. On its basis the famous doctrine of Weber was developed. It is a common experience that when very little difference exists it becomes difficult to separate two sensations. For example; if you are asked to lift two boxes one at a time which have very little difference then you cannot tell which is heavier and which is lighter. If a small thing is kept inside a box and if one is asked to tell the difference by picking up the box then it is not necessary that the difference will be perceived. Here the question arises that what difference in the weights of the boxes should be kept so that the difference is known or what minimum weight in one of the box is increased in comparison to the other so that the weight is felt to be increased. Similar questions related to other sensations may also be raised. Weber, the pupil of Wundt, also had interest in this kind of experiments. We experimented to know what must be the difference among weights so that they may be felt by manually lifting them or what minimum weight should be increased so that difference between two weights is known.

Weber saw in his experiments that 29 ounce in comparison to 30 ounce and 30 ounce in comparison to 31 ounce is felt to be slightly heavier by close observation. This difference of 1 ounce may be recognised and Weber saw by experimenting that a difference of ½ ounce is known with great difficulty but less than this difference cannot be felt.

By his experiments on temperature, smell, hearing, vision, sensations of the skin and muscles, Weber reached the conclusion that to make out the difference between two sensations, relative differenc... and absolute difference is needed. This difference, as has bee... shown earlier by the description of various experiments, is differe... in different persons and even for the same one person. Weber s... that the perception of the difference in sensations does not dep... directly on their difference as much as it depends on their relati... To verify this conclusion he did some experiments related to... eye. He produced pairs of lines in front of the subject and a... him to say which line seemed to be longer. These experiment... ther strengthen the theory of relativity. Weber saw in his exper...

that in comparison to sensations of the muscle difference in visual sensation can be recognised inspite of factorial differences.

On the basis of experiments, Weber conceived of the minimum recognisable difference which exists in the case of different sensations This difference came to be known as J.N.D. or Just Noticeable Difference In the language of experiment it is known as Difference *Limen (DL)* Here the objection was raised that how many times a difference should be recognised to be called DL It was decided in this respect that it should happen 75 times out of 100. Weber also saw that DL was always a fraction of the stationary thing out of those compared and is always stationary. For example the weight of 30 ounce is stationary and by comparing it with a weight of 31 ounce, 1 ounce DL is found This DL is 1/30 of the stationary substance. Now even if 30 is made 60 then too DL will remain 1/30 of the stationary substance or the substance recognised should be $\frac{1}{30} \times 60 = 2$ *ounce more than the other.* By experimenting on suit-cases Weber saw that to be recognized suitcases weighing 31 pounds in comparison to 30, 62 pounds in comparison to 60 and 93 pounds in comparison to 90 pounds should be used In this it was seen that for the difference to be recognizable it should be 1, 2 and 3 lbs for weights of *30, 60* and *90 lbs.*

From this it is clear that in every condition DL is the same fraction of the standard.

From this conclusion Weber formed the law that 'The increase in any given stimulus which is correctly perceived in 75 per cent of the trials is a constant fraction of the size of the stimulus' In the examples of suit-cases the constant fraction of the standard in every case remained 1/30 In this way in 75 per cent experiments in suit-cases of 30, 60 and 90 pounds the correctly recognised increase was *1, 2 and 3 respectively*

In various fields, Weber tried to find support for his own theory in the experiments of other scientists For example, Weber mentioned Delezenne's experiments related to hearing in support of his own ideas, though his view was wrong

Many scientists criticized Weber's theory and it was refused later on, but his importance in the history of psychology cannot be determined by the correctness or wrongness of his theory Weber appeared in Germany at a time when German scientists had been busy in various kinds of experiments since the last century. French findings were being welcomed in the beginning of 19th Century in the German universities At this time associationism predominated

in England. Though Hamilton experimented with the problems of attention, they had no effect on the majority of the scientists. A generation before the age of Weber Bouguer in France had experimented with the sensitivity of eyes towards light. But no special results came out of it. When this was the state of experimental science in other countries, at that time Weber established experimental psychology on a firm footing in Germany. The thing to be noted in Weber's experiments is that he tried to express in Quantitative words the law of the sensations of different sense organs. He saw his problems from the experimental point of view. He tried to find out a universal law on the basis of various laws. This experimental view point is the peculiarity of Weber. By his experiments many physiologists were inspired to start work in their laboratories on psychology problems. It was the problem presentented by him on which scientists Helmholtz, Fechner and Lotze performed useful experiments. Weber not only presented problems but himself experimented to solve them and the most important thing is that he led the path to organised study.

In the history of psychology, Weber's importance lies in this that he tried to gauge the reactions of man towards the outer world. From his time to the present the sphere of measurement in the field of psychology has gone on increasing. As the sphere goes on increasing psychology becomes more scientific. Nowadays in Psychometry from small sensations and feelings to complicated social tendencies all are measured. It need not be said that Weber established this system of measurement by his experiments. Gardener Murphy has written correctly about Weber and his theory that "Important as this law was to become as a hypothesis of voluminous research, Weber's greatest significance lies rather in his conception of an experimental approach to psychological question, and in the stimulation of research through which ultimately a vast variety of problems other than this have been incisively studied".

Q. 28 Write short note on the following -Fechner as a psycho-physicist *(Kanpur 1968)*

"Fechner in distinction from Weber was an eventmaking man." Comment. *(Kanpur 1959)*

Often Fechner's name is taken along with Weber. But it will be wrong to think that in the history of Psychology there is no independent importance of Fechner. One main branch of psychology is psycho-physics. In psycho-physics the relations between physical stimuli and mental actions are realistically studied. In 1879 when

the famous German psychologist Wundt established the first psychological laboratory at Leipzig, the foundation of psycho-physics was laid but the credit should go to Fechner for encouraging Wundt and other contemporaries to experiment with various psycho-physical problems. In the words of Gardener Murphy, "Indeed, Fechner's long and careful research did much to give Wundt and his contemporaries the plan of experimental psychology." Before the establishment of Wundt's laboratory, Fechner published in 1860, his famous book '*Elemente der Psychophysik*'. Before this book was published, Fechner had written a scientific article on mental measurement in 1858. In this article Fechner had given the definition of psychophysics and determined its sphere. According to Fechner, psychophysics was a science studying the relations of interdepennence between the mind and the body, as well at the functional relations, Sensations, perception, feelings, actions, attention etc. come in its sphere. According to Fechner sensations can be most successfully measured. In this way according to him sensations is formed by various sensation units and standardization of these units can be done. The standardization would be none on the basis of their relationship with the stimulus Fechner differentiated between inner psychophysics and outer psychophysics in which a comparison between physiological responses and internal feelings is made On the other side in internal psychophysics the relationship of subjective feeling with physical feelings can be measured, for example the relation between the sensations and mental changes can be studied.

Fechner experimented for years with Weber's law and found that when a uniform increase is effected in the stimulus, then there is a similar increase in the sensations resulting from them. This increase does not occur in a simple ratio but is in comparison to the increase in the excitement Hence relation between excitement and sensation is shown by a curve. It is seen that this curve always bends down in the graph of stimuli and sensation

On the basis of the above finding Fechner discovered a law that the sensations are in a ratio of the Log of the stimulus responsible for them. If sensation is shown by S, stimulus by R and constant as C then Fechner's law can be expressed by this that $S = C \log R$ This equation is known as Weber-Fechner's law. In it both sensation and stimulus are changeable. only C is constant This law is the amended form of Weber's law. Hence it is famous in the name of both Weber and Fechner.

But there is great difference in the hypothesis of Weber and Fechner though they reached agreement over a law. Weber was only interested in the just recognisable difference which on other side Fechner's aim was to mathematically define the relation between physical and spiritual world. Still Fechner developed Weber's method of just recognisable difference by experiments for many years. Fechner experimented on the sensations of eye ond temperature. He created experiments similar to Weber's in which two stimuli are presented and one of these is increased or decreased to reach a barely recognisable difference among the two. Here a difference between the viewpoints of Weber and Fechner is noteworthy. Fechner has stressed in this experimenting on proceeding from both ends and found out the average of the just recognisable differences found out by the increase and decrease. Fechner. in addition to his experiments on the sensation of temperature and vision also experimented on sensation of lifting weights and skin sensations.

In the weight lifting experiments Fechner compared the weights over 67000 times. In this case he experimented with the method of right and wrong cases. The method had been originally started by Vierordt. In the method of right and wrong cases the stimulus remain constant and decisions are changed. In this way by taking any particular difference which can be generally equally recognisable but whose being recognised is not absolute, and correct, incorrect and doubtful decisions are taken. Then necessary difference is found out to give percentage to correct cases in the basis of the theory of probability. In this way the aim of this method is to find that stimulus by which correct decisions in a definite ratio are provided.

Fechner found out the method of average error for experimenting on the measurement of sensations related to skin and vision He developed this method with the cooperation of Volkmann This method had been in use in palmistry. This method is based on the belief that the errors of observation and decision are also dependent on variability and quantity of stimulus as much as upon the internal and external circumstances In this method a stimulus is left constant and with its help a variable stimulus is adjusted according to intrinsic similarity. The stimulus adjusted by the observer is the error stimulus. The mean value of the difference of given stimuli will be determined by the subject's error of observation in the controlled conditions. For example in the experiment of lifting weights, the subjects take up a particular weight and try to form another

weight similar to it. When he fixes a second weight similar to the first then he weight it to find his own fault. In this way he tries to give the weights of various quantities and every time finds out his mistake by weighing the guessed weight. Now by finding out the average of the results of the experiments the average error can be found.

To understand Fechner's experiments it is necessary to know their philosophical background. The aim of Fechner's experiment is to find out the extent to which science might be helpful in the study of man in relation with nature. Fechner wanted to experiment upon the actual methods being used successfully in the natural sciences in the outside world His problem was to find some way so that the soul be visible and seen in observable conditions.

Fechner was influenced by the philosophies of Fichte and Schelling. The philosophy of nature in search of a spiritual meaning in the events in their natural order influenced Fechner On the other side he was a student of medicine and he had deeply studied physics and chemistry He was also interested in mechanics and contemporary inventions regarding electricity The fact is that Fechner was an authoritative scholar of physical sciences in his time.

Being influenced by both philosophy and science a strange combination of the two was seen in Fechner. As is evident in his problems, he wanted to find a way to solve his problems without being tied down to any ideology In finding a path he adopted many things from the philosophy of nature but then opposed other things. He wrote many sarcastic articles on mechanistic science. He saw that the spiritual legacy was so complicated that it could not be understood by scientific ideas He opposed the description of biological sciences by the ideas of mathematics and physics. His view was that it was an effort to boycott life and mind He found this effort to be opposed to the nature of biology and psychology. For him every particle of nature was meaningful and due to this it was not appropriate to study it by the methods of physics and chemistry because it opposed all the life element of the world

On the other side Fechner felt the necessity for a sure and correct method in zoology and psychology. He saw that observed facts in these sciences could not be defined by existing methods. Hence whereas on one side he was writing satirical articles under a psuedonym, he was also doing research in the field of Physics In fact by writing satirical articles his aim was not to oppose science but to understand it. He wanted to find an aspect of science, and to find

a method by which actual knowledge of things both in the human soul and external world could be gained. He put great labour in his effort. He even lost his health. He was studying after-images by taking the high stimulus of the solar rays. This caused great pain in his eyes and for many years he was unable to see clearly. He could not read and think properly. He would have definitely lost his health but he slowly regained with it the help of his wife.

As has been told earlier the main problem for Fechner was to find out the mutual relations between mental and physical actions. As a result of thinking and experiment he learnt one day that quantitative relations exist in the facts of our physical life. In other words with the increase of stimulus there is no equal increase in sensations. Instead if a stimulus is taken in geometrical progression, then sensatiens occurs in arithmetical progression. For example if a bell is ringing then the effect on us by ringing a second bell along with it is not the same if we add the sound of the first bell to ten bells. It means that the effect of one bell combining with ten bells, is much less than the effect due to its combining with another bell. Another example is that if 4-6 candles are burning then by adding another candle to them, no great difference in the light is seen On the other hand if a single candle is burning, a sufficient difference in lighs occurs by burning another candle. It is clear that the effect of stimulus cannot be similar under all circumstances. Its effect depends on the existing stimulus. Or the effect of stimulus is relative to the already existing stimulus. If the already existing stimulus is so great that no great difference is seen in it by the addition of new stimulus then there will be no difference in the effect too.

In his many experiments Fechner saw that with some increase in a definite ratio in our sensations in the different sensory sensations a difference in the sensation is seen. In this way, like Weber, Fechner arrived at the theory of just recognisable difference, which has been described earlier.

In this way by the theory of just recognisable difference Fechner reached the quantitative relation between the mental and the physical worlds. A mathematical relation has to be established between these two worlds by the Weber-Fechner law. Fechner has described this finding in his book '*Zend avesta*'. In this book he has elaborated his philosophy of nature. As is evident from its name there is a mark of Persian philosophy and its dualism on Fechner's philosophy of nature. According to Persian philosophy there is the dualism of good and bad in human beings. Fechner saw the world

not in the form of a contradiction between the mental and physical but in the form of their combination. The world is natural, but still a mental definition of it can be made.

In this way, the problem which Fechner took up seems to be solved by both experiment and reasoning. But he was not satisfied with his conclusion and hence he continually experimented. In these experiments he laid the foundation of experimental aesthetics. He tried to find out by many things of daily life like books, windows, cards etc., the relations that existed in their shapes and which can termed as beautiful. Along with artilces of daily life he also studied samples of art. His effort was towards establishing some facts about experimental method in the field of aesthetics. He was against evaluation of beauty by some definite principles. He wanted to give *an experimental basis to aesthetics*

Fechner tried throughout his life to combine the scientific and mystic ideas Nowadays most of the scientists believe this combination to be difficult if not impossible though still in every sphere of science scientists can be seen agreeing with Fechner's views. Fechner saw *the whole world in the form of a living organic being. He saw* life and soul in every particle of nature There is consciousness in every object of the world and it reacts towards other objects In this way Fechner's view of nature is totally monistic. Hence Fechner should not be understood as a parallelist in psycho-physical relations. He does not differentiate between man's internal experience and the reality of the outer world. We experience objects as they are or if a causal study of the outer world could be made then a similar study of the internal world can also be made. In this way Fechner stressed the use of the methods of physics and mathematics in zoological and psychological experiments Every science studies life in different ways. Everywhere there is life, consciousness, soul etc. Everywhere its different relations can be measured. Everywhere it can be learnt by mathematical methods. Everywhere it can be causally or quantitatively defined. There may not be complete truth in these views of Fechner and even if all do not agree with his view, there is no doubt that he encouraged experimental study in the field of biology, psychology and aesthetics In the history of psychology he should be acknowledged as the actual creator of psycho-physics.

Q. 29. Assess the contribution of either Muller or Mesmer in the development of modern psychology. *(Agra 1968 1969)*

Johannes Muller was born in 1801 and was a contemporary of Fechner. He was interested in Physiology. In 1833 he was appointed professor of Physiology in Berlin University. Muller is known as a great experimentalist of the 19th century because he performed many important experiments related to the sensations and propounded many new facts. He made a profound study physiology in his period of teaching and threw light on the various actions of the body. He published a book 'Elements of Physiology' on the science of physical actions which soon became popular. This book was published in 1833 in the German language and in English in 1838. In this book many subjects had been defined which were of great importance from the psychological viewpoint.

Muller was generally interested in the actions related to sensation and he centered his study on optical sensation. Mostly his experiments were related to the action of the external organs of the eyes and space perception. These facts were influenced by Kant's principle of space perception. Kant had accepted the knowledge of space to be subjective and had said that it was a natural characteristic of the soul. Berkeley had said about visual space perception that whatever we see is a sign or symbol which prepares us for necessary action. Herbert considered space to be a combination of some special experiences. But Muller threw light on the question that in what way a thing is affected by inspection and how are they again remembered. He said that every person has the ability to know Space but he cannot know definitely its distance shape and position. Man knows by his experiences whether a certain thing is within his reach or not.

Muller also threw light on reflex action. He said on the basis of his experiments that the brain and the spinal cord is concerned with all physical actions and reflex action is based on them.

Muller has propounded a very important principle related to sensation which is known as the doctrine of 'specific energies'. According to this doctrine there is a special kind of energy in the nerves of the body. When a nerve is connected with a stimulus, then a unique reaction occurs. For example, visual nerves only perform the function of seeing and auditory nerves that of hearing. Similarly there is sensation of cold by dropping cold water on the skin. Sensations related to temperature also occur in the same way.

Hence Muller made it clear that the nature of sensation depended on that nerve which comes in contact with the stimulus.

In this way he said that the idea was wrong that the nature of sensation depends upon the stimulus related to it. In fact the basis of sensation is the nerve and the energy in it.

Muller also defined mental actions. He said that a person's images related to experience are formed on the basis of the nervous system and then these exist and are transferred to the memory. Equality and co-existence help in association In fact these are the different forms of association The individual has the ability to limit association according to his need and in this way brings in memory the objects and images directly concerning him If he does not do so then association related to many things will occur at the same time and mental work will become confused. In this way, Muller defined the limited and general aspects of association.

Muller has written about feelings that in favourable circumstances feelings are created by the similarity of difference of ideas. In this way the feeling of happiness occurs in man when he is successful in his efforts while a feeling of sorrow is due to failure

Muller has also accepted body to be the basis of emotion. In a condition of emotion there is sensation inside the body. In other words, the sensations which occur in the body on the basis of nerves are known as emotions

Muller has also thrown light on will power. Will power is related to attention Will power can work towards that object on which our attention is centred Here it is necessary to know the difference between voluntary and involuntary actions of a person. A person can only control those actions which occur according to his will The actions which do not occur according to his will cannot be controlled by the individual.

It is clear in the above brief description that Muller had said while throwing light on the mutual relation between Physiology and Psychology, that the basis of psychology was physical. He gave great importance to the nervous system and whatever he wrote in this respect is the basis of the study of modern neurology He stressed greatly the physiology aspect The reason for this is that his main subject was physiology He is among the famous German psychologists of the 19th Century.

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Perceptual Processes

Q. 30. What is perception ? What light does study of illusions throw on perception ? *(Osmania 1964)*

What is Perception ?

Ans. Perception is the interpretation of the meanings of sensations. In seeing a rose the various sensations of colour, smell, touch etc. are aroused. We are given to understand by these sensations that there is an object infront of us. We know from past experience that an object of this nature is a flower or a rose. We therefore conclude that we are beholding a rose.

Perception is a mental activity which acquaints us with the situation by giving us direct knowledge of it. The sensations are viewed as a whole, in perception. In perception there is not just a prefunctury acquaintance with the object, there is a knowledge of it too, whereas, in sensation, the individual does not know the object. The sensation of pink colour may have been excited either by some paper or some cotton wool or any thing else. The sensation of colour alone is not a sufficient proof of the identity of the object, and it is, consequently, not possible to say on the basis of the colour sensation that the pink object is a rose. The real meaning of the sensation is understood or revealed in the perception. Only then is it known that the sensation originates from the rose. Accordingly, sensation precedes perception. Woodworth expresses it in this way, "In general, when we speak of sensation we are thinking of stimuli and investigating the relationship of the individual's experiences to various stimuli which reach his receptors, and when we speak of perception we are thinking of objects and are investigating how well the individual experiences correspond with the objective facts."

The value of past experience in perception.

Sensation is not the only constituent of perception. Perception is caused by recognition based on past experiences. The perception of the rose is a recognition of it, as such by the perceiver.

In this way, perception is an assimilation of recognition and sensation. Perception is the understanding of the sensory signs. This account should not create the impression that these processes of sensation and recognition take place step by step. In fact, all processes take place at such high speed that there is no knowledge of them. It appears that the perception takes place immediately the flower enters the line of vision As Ward very aptly and truthfully says, "Pure sensation is a psychological myth." Even the presence of sensation is known upon an analysis of the perception. The understanding of the sensation in perception does not depend exclusively upon past experience Time, environment, mental set, local indications, muscular sensations and unconscious traces, all play an important part in the process.

Perception of Sensation

The distinction between sensation and perception is similar to the one between a whole and its part. Neither of the two is possible without the other Sensations are the constituents and raw materials of perception. The perception of the external world depends upon the sensations of colour, form, sound, taste, smell, heat, cold, density, amplitude etc Just as the whole cannot exist without its parts, in the same way, perception is not possible in the absence of sensations. For example, the perception of the rose involves the experience of the sensations of the colour, smell, touch etc To put the same more scientifically, the analysis of the perception of the rose yields these sensations. Sensation is a presentative process

The second difference between sensation and perception is that while the former is a rudimentary and simple experience of life the latter is the complex of these simple experiences It includes a memory of past experiences too For this reason perception has been termed a "Presentative-representative process" In the opinion of Woodworth sensation is the first response of the brain while perception is the second. Sensation is the first or at least the first conscious *response born of the stimuli* *Perception is the second* response after sensation and in more appropriate words it is the direct response to the sensation and only an indirect response to the physical stimulus The order of events is stimulation, response of *the specific senseorgan and sensory nerve*, first cortical response which is the sensation, and cortical response which is the perception Using the old example, the presence of the rose first stimulates the

...ecific sense organs. The sensory nerves convey this experience to ...eas of the cortex concerned. The sensation arises. The third ...ifference between the two is that sensation precedes perception.

Q. 31. Define Perception and analyse the factors involved in it. (*Bombay 1964, 58, 66; Gujrat 58, 65, 53, Karnatak 68*)

What are the various factors that influence perception ? Explain with illustrations. (*Karnatak 1955*)

Various Processes in Perception

Ans. Perception being a complex process, reveals four processes, on analysis :

1. *Receptor process* : The first process in perception is the receptor process. The rose, by virtue of its presence, stimulated three different receptor cells thus activating three different receptor processes.

2. *Unification process* : This is the second step in the main process. For a perception of the rose a unification of the different sensations is necessary. Even if the flower were to be seen or rather experienced by the eye, a unification of all the sensations from the different parts of the flower is a must.

3. *Symbolic process* : This process is the next, the third process in perception. From our daily life, we know that most things have a feeling or an experience attached to them. A rose reminds us of the friend who created in us the interest for roses. The flower symbolises the friend. Thus every time we perceive a rose, this symbolic process makes it much more than just a rose.

4. *Affective process* : This too is attached to perception, because a flower may arouse a happy memory of a friend or a feeling of sorrow at their separation. Besides being pleasant or unpleasant, the process may also be indifferent.

The above detailed analysis of the processes of the perception will make it clear that it is a complex process and not merely an aggregation of sensations. But even though it is a complex process involving many processes, its basic constituents or components ar... still sensations and past experiences.

Q. 32 Explain principles of perceptual grouping. (*Poona 19...*)

What is perception ? Discuss the role of Figure and Gro... in determining perception ? (*Bombay 1955; Gujrat 57, Karnatak 66,...*)

Distinguish between sensation and perception. What ar... laws of sensory organizatiod ? (*Bombay...*)

"A perception is nothing more than a sensation." Evaluate this statement in the light of Gestalt theory. *(Ravishankar 1966)*

Ans. The Gestaltists opined that perception is not the mere aggregate of sensations and past experiences It cannot be elaborately explained on the basis of past experiences. The real form of *the object is to be taken as a whole. In German the* word for form is Gestalton, while in English it is Gestalt. This gestalt is very important in perception. A face is beautiful because of the effect of this gestalt. This theory on the subject of perception was first introduced in psychology by the gestalt psychologists. In 1912. Wertheimer announced on the basis of his experiments, that the perceptions by the various sense organs, eyes, nose, ear, tongue etc. take place as a whole The tune issuing from the harmonium is very pleasant, but if this tune is analysed into its notes, the tune vanishes.

According to the gestalt theory, perception is fixed or controlled by the psychological activities in the nervous system which result from the stimulation from physical objects Whatever the person sees depends to a great extent upon the sensations from the perceived object.

The orchestra in film music is very attractive, because the sound of many instruments is incorporated in it. If the basic constituents of a scent are smelled the odour *may be detestable*, in contrast to the delightful smell of the scent in the form of a compound in its finished state.

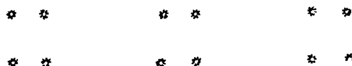


Fig 3

The flowers illustrated above are nothing strange, because you must have seen them in many books *But do you notice anything* special about them ? Of course you do, as you notice that they are divided into 3 groups of four each. Obviously, the physical position and the spatial relation of the objects influence their preception. The spatial relation depends not on the perceiver but on the perceived object These independent sensations which, in the field of knowledge, establish the specific organisations are known as the constructuctive *organs of the process of perception.*

Determining Laws of Figure and Background

The Gestalt psychologists did not rest content with the laws of organisation but they also provided laws, based on experimental findings, which determine the figure and background. These laws are as follows :—

1. The Law of Similarity—This is the first law. Two parts similar in any way, *e.g.*, colour, figure, extension, etc , have a tendency to become organised.

When we direct our attention to the asterisks in the figure No. 5 we see organised framework of three perpendicular and five horizontal lines. Similarly, if our attention is focussed on the circles we see an organised figure in the form of four perpendicular and two horizontal lines. But, ordinarily we do not see the square drawn on the right, and even if we do, it stands out by itself a solitary figure. It is not organised either with the circles or with the asterisks

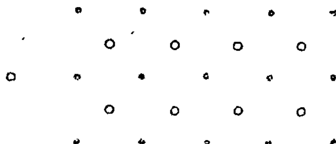


Fig. 5.

It is clear from this description that similar parts become organised and are viewed as wholes

2. The Law of Proximity—The second determinant law is the law of proximity which states that objects in close proximity in time and space exhibit a tendency to organise with the result that they are perceived as wholes

3 The Law of Symmetry—This is the third law. When placed in an order or symmetry, the various parts become organised into a whole and they are then perceived as such. This is more effective than either similarity or proximity.

4. The Law of Homogeneity—The fourth determinant of figure and background is the law of homogeneity. Two parts of equal intensity or brightness are easily assimilated In a given figure in one there were two concentric circles while in the other space

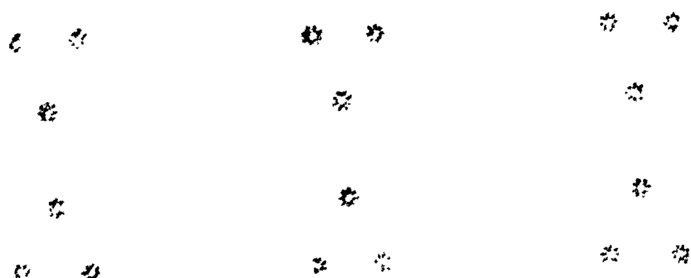
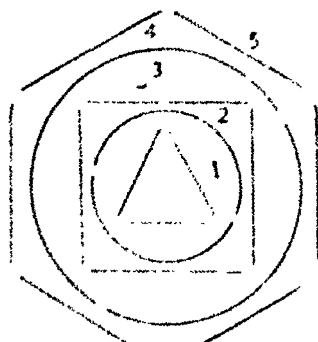


Fig. 6.

in between the same circles was coloured. They were, therefore, organised and gave the appearance of a ring, instead of two circles.

5. *Continuity*—This too, has an effect on organisation. The law of constancy was enunciated on the basis of continuity.

6. *Closure*—This too, when compared to continuity, has an effect on the organisation of parts. See the figure No. 7. On first seeing it one observes, a triangle, a circle, a square, another circle and a hexagon. If the eye is now moved along the lines of each figure, nothing is visible. Three lines are of course visible but they do not make any angle because they do not meet. A careful observation, similar to the preceding one, of the two circles, the square and the hexagon will reveal that there is no figure in the picture. The illusion of figures in the first case was caused by closure which did not allow the attention to dwell on the gaps, so that the figures appeared organised.

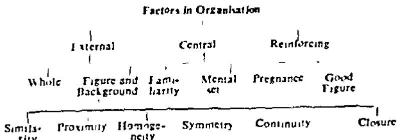


1. *Familiarity*—The organisation with which the person is acquainted is perceived easily and with alacrity. Seeing a familiar picture quiz we at once understand its reality and solution and the remaining figure forms no obstacle in this If this picture quiz is presented to some uninitiated person he will be unable to fathom its secret But if the acquainted person is affected by some other part of the picture, he will be incapable of recognising it, notwithstanding his familiarity. Therefore, the Gestalt psychologists give it as their considered opinion that familiarity may or may not affect perception

2. *Mental set*—This is the second central factor. Mental set has a by no means insignificant effect upon the organisation of the sensations. One of the causes of mental set is habit. For example, a philosophor looks at the truths of the universe while trader is always involved in wordly things, because they both need this for their differing occupations. Mental set may also be created by a situation as a person, finds himself exasperated at the slow speed of a carriage This is inspite of the fact that it is the fastest carriage It is because of his hurry to get to his destination The differences in mental set are the cause of the varied perception of the same thing by different people at the same time or the same people at different times.

Reinforcing Factors

The Gestaltists believed in reinforcing factors, besides the other two These include pregnance and good figure The supplementing of the incomplete is a mental tendency, which diverts our attention from the gaps and presents a circle The idea of Good Figure is explained by the picture in the description of closure



Q 33. What are Illusions ? Explain with the help of examples the illusions caused by various factors

(Punjab 1963, Agra 1957 1963, Raj 1957)

Write note on—Geometrical illusion. *(Poona 1963)*

Distinguish between an illusion and a hallucination. *(Bombay 1959)*

Ans. An illusion is a misinterpretation of the correct meaning of a perception. It is not a dream because the perceived object is present and it is not imagination because the object of perception is not a creation of the mind of the individual. An illusion is a wrong or false perception. A stick appears crooked when held partly under water. This is perception, of course, but not in keeping with the situation of the perceived object as it is falsified due to some reasons.

HALLUCINATION

Difference between Illusion and Hallucination

Hallucination is dissimilar to Illusion. The vision of an oasis at a distance in a desert is a hallucination. Some people see a ghost in the dark. This is another example of a hallucination. Some people relate strange incidents of hallucination *e.g.*, a woman dressed in a white saree came at midnight and sat down on my bed and she messaged my feet etc. There are examples of hallucinations.

There are the following differences between hallucination and illusion :—

1. In illusion, there is a distinct external stimulus, while in the case of hallucination the external stimuli is often absent, as exemplified by the example of the white-robed woman.

2. While illusion often happens to very ordinary people, hallucination befalls the lot of mentally afflicated, tired or intoxicated people.

3. In illusion the stimulation is usually external while the stimulations in hallucinations are in the person himself, which makes the latter a kind of subjective perception.

4. The perception of the same situation is identical to every person in the case of illusion. The stick in the water appears bent to every observer. The illusion is thus a primitive organisation. On the other hand, in a special condition different people have different types of hallucinations due to diversified intoxications. Some people see ghosts, others snake while still other people see giants with swords when in an uncommonly intoxicated condition.

Distinction between Illusion and Hallucination

Illusion	*Hallucination*
1 The stimulus is explicit.	1. The stimulus is not clear.
2 Happens in a normal condition.	2. *Happens is an abnormal condition.*
3. The stimulus is external.	3. It is in person himself.
4 *The experience is identical for* everyone, in the same situation.	4. The experiences vary in different people in the same situation

Types of Illusion

A comprehensive classification of illusions is made under two heads—Personal and General. *The personal illusions are those* which differ from individual to individual. In the dark some people mistake a rope for a snake but a person unfamiliar with a snake cannot *make this mistake.* On *the contrary he is more likely to* mistake a snake for rope. The common illusions are of a universal kind and are similar in the case of every person. The railway tracks appear to meet at a distance which is an experience common

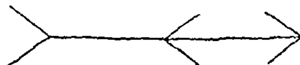


Fig 8

to all. Geometrical illusions are similar in appearance to everyone. *A famous example of an illusion, is Muller Layer Illusion. The* straight *line* is divided into equal parts at the apex of the middle angle but the left part appear longer

Causes of Illusion :

There are many theories which were advanced to explain the phenomena of illusions. The following is a collection of the causes according to the various theories.

1. *Confusion* : One of the major causes of geometrical and similar illusions is confusion Confusion means the impurity or inaccuracy of perception of the various parts of a picture. *Often a* beautiful form tends to cause illusion by confusing. While looking at a picture, the person becomes so engrossed in that he does not notice the peculiarities of the parts or the merits *and demerits of* the picture,

. *Eye Movement* : The movement of the eyes has a lot to th the creation of illusions. In a given figure, there was a r strain on the eyes in viewing the perpendicular than the ontal line with the result that the former appeared longer.

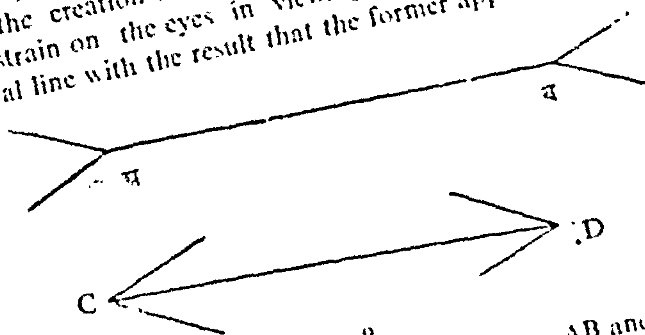


Fig. 9

In the Muller Lyer Illusion Fig. 9 the lines AB and CD are of equal lengths, though AB appears longer due to eye movement. AB is the feather headed line while CD is the arrow headed line. Comparatively, there is more eye movement in perceiving the feather headed line than in perceiving the arrow headed line. Therefore, the former appears longer than the latter. Actual eye movement is not necessary, because even an equivalent tendency to it will be sufficient to cause an illusion

3. *Tendency Towards Wholes* . This is another cause of illusions. This theory of illusions is the creation of the Gestalt psychologists. In perception there is a tendency to view the whole. This tendency towards whole is also known as the tendency towards the perception of Good Figure The tendency to the perception of good figures or wholes leads sometimes to the perception of angles in the triangle which were not there.

4 *Prospective* It is another cause of illusion. due to which very object appears three dimensional The perception of a figure in the context of perspective is illusory

5 *Emotion* In an emotional [illegible] perception is often false and this causes an illusion In fear the [illegible] appears in the form of a snake while the scraping noise created by rats feels like the walking of thieves

6. *Contrast of Stimuli* Yet an[illegible] cause of illusions is the contrast of stimuli A fair face [illegible] fair if viewed next to a dark face due to the sharp [illegible]

In the following [illegible] circles A and B are of equal diameter, but because A [illegible] [illegible]unded by asterisks while B

surrounded by circles, B appears smaller than A. Many of the above mentioned reasons are at work in this illusion A looks bigger in contrast to its surrounding asterisks but B looks smaller due to an unavoidable comparison with its surrounding circles, so that, on the whole, B appears smaller than A. B also looks bigger than A because we tend to observe the whole picture with the result that the 'tendency towords wholes or a perception of good figures comes into play. The perception is illusory due to an imperfect isolation and also due to eye movement and confusion

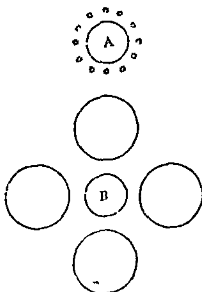


Fig 10

7. *Preconception*—This, too, causes illusions. If for example, a person is daily visited at a fixed hour, the person may feel that he has heard his name pronounced, on a day when the friend has not actually put in an appeararce

8. *Habits*—Habits also cause illusion as is examplified by the mistakes of the inexperienced proof readers.

9. *Defects of Sense Organs*—Defective sense organs cause incorrect perception and consequently an illusion A person running a temperature finds sugar tasteless

10. *Imperfect Isolation*—There is a possibility of deception due to imperfect isolation, an example of which is the Size-Weight

...on. Two boxes of equal weight but of very unequal size are ... A person lifting them will report that the smaller is infinitely ...ier.

The above description includes all the major causes of illusion

Q. 34. What are the characteristics of a perception ? Ex...ain by an example as to what is meant by reduced cues and am...ous signs.

Ans. Prof. Stout has enumerated the characteristics of p...eption as follows :

1. Unity and Continuity.
2. Attention.
3. Persistence with varied efforts.
4. Free adaptation to varying conditions.
5. Learning by experience.
6. Reproduction in perception

1. Unity and Continuity

The sensations are not scattered in perception. Perception is not possible if the sensations are scattered because they would, in that case, lack meaning. The perception of an orange includes the sensation of colour, taste, smell etc., which are unseparated. There is a unity and continuity in the sensations which enable us to perceive an orange.

2. Attention

Perception is the understanding of [illegible] sensations. Thus the proximity of the sense organ and the object does not bring about perception if there is no attention. [illegible] noticed the building you pass by daily though it [illegible] vision, because you never paid attention [illegible]

3. Persistence with varied efforts

The observer has [illegible] for complex perceptions. If, for example, a [illegible] which you are unfamiliar, is placed [illegible] not rest content with a mere glance at it but [illegible] in your hand, smell it and, if it is [illegible] changing perceptions have a unity and [illegible]

4. Free adaptation to varying circumstances

In some cases [illegible] the sensations are constantl[y] changing. The wrestler [illegible] the tricks his opponent us[es]

In this preception the sensations are changing. The wrestler has to adapt himself the changing behaviour of his oppenent.

5. Learning by experience

It is difficult to perceive an object with which one is totally unfamiliar. A person who has never seen a kite flying cannot make anything out of the sensation of a patch of colour in the sky. Of course, if the once sees a kite, he will be able to recognise the *sensation of colour in the sky and identify it as a kite.*

6. Recollection

The above example shows that there was a recollection of past experience concerning kite and that the assimilations of present sensations and recollected past experiences resulted in the perception of a kite. Recollection is, thus, a speciality as well as a sign of perception

Ambiguous signs

Perception does not make it mandatory that the complete object be present. You perceive a friend on hearing his voice. This is because the sound is an ambiguous sign of his presence. Mostly, *objects are seen in the form of signs.*

The bell was an indication of food in Pavlov's experiments on dogs, while the reaction was the same as in the case of a perception of food.

Reduced sign

These are, as their title conveys, incomplete or reduced indications of the presence of an object. The dronning in the sky is a reduced sign of the presence of an aeroplane. The result is an *indirect perception of the approaching or present aircraft*

Thus besides the characteristic mentioned earlier, signs and indications have their importance in perception

Q. 35. Explain visual space perception. Explain fully the binocular determinants of perceived distance. *(Poona 1965)*

Ans. The relative distance of the different objects is known through active touch and movements. By active movements there is a direct perception of the distance. This preception of the distance is constituted by two elements. (1) Tactual sensation and (2) Muscular or movement sensation. Thus, by extending the hand or the leg, one has the perception of short distances. Long distances are however perceived through walking or running. The distance is not directly perceived through the vision. Perception

the distance through the vision depend on visual signs. These visual signr are not innate or inborn, but acquired. The include various types of shades, the differences of colours, relative motion, the definiteness or indefiniteness of the outlines etc e.g., if a tree is clear than another, it will be perceived nearer than the other. Thus clearness is a visual sign of the distance. As a general rule things nearer to us are seen clearer than those which are at a distance. Again, if a big thing is perceived as small, one infers that it is at a long distance. Similarly if the colour of an object is not bright, it is at a greater distance than when it appears brighter. Thus the different visual signs help the vision to determine the relative distance of different objects

The relative distance is not determined either purely by movement or purely through vision. As a matter of fact both movement and vision co-ordinate in the perception of distance.

Q. 36. Describe the chief elements that enter into the visual perception of space. *(Agra 1954)*

Ans. According to Prof Stout the new born baby has only a vague and indefinite perception of space, and space perception becomes definite and clear with experience and mental development. Thus, the space perception is acquired and is not in born This is acquired through these important elements (1) Extensity, (2), Local signs and (3) Movement These three elements co-ordinate in the perception of space

1. Extensity Extension is an activity of the body while extensity is an attribute of sensation Every space has matter and form Extensity signifies the material aspect of space It is an attribute of spreading out, possessed by sensation e.g. the pressure of a needle on the skin is very little extended in comparison to that of a coin If you put your finger in the water and [illegible] the whole hand into it, the latter sensation [illegible] more extended than the former one The sound of a clock [illegible] less extended than the sound of a shot, just as the light [illegible] has less extensity than the glare of [illegible] All these examples make it clear that different [illegible] extensity. Thus, extensity is not an attribute [illegible] the sensations. According to Prof. Stout, [illegible] material part of extensity while space the formal part [illegible]

Thus the perception [illegible] space starts with extensity in [illegible] But this alone [illegible] different ones as has already [illegible]

pointed out it is only the material part of the extension while the space is the formal part. Hence extensity requires space for its form. This space perception is not in-born, but acquired. It is acquired by learning the position, distance and direction of the different parts of an extended substance

2 Local sign—The second important element in the perception of space is local signs. It is through these that the local parts of a space are distinguished. "Local signs are qualities, which vary, independing of the nature of stimulus, according to the nature of stimulus, according as this or that part of the surface is effected" Thus, the same stimulus creates different sensations on the different parts of the body. Local signs are not a quality of the stimulus It is because no two parts of the body are identically the same. Hence different parts have different sensations from the same stimulus e g. the sensation of the touch on the cheek is very much different from the sensation of the touch on palm. If one touches the tip of one's nose, one experiences a different sensation than if the bridge of the nose is touched. Thus sensation of different parts of the same hand are different The sensation on the palm is different from the sensation on the hand Again, different spots of the retina have different sensations of the same stimulus The difference in sensations causes difference in local signs, by knowing which the precise position of a sensation can be determined e g., in a pin pricking the back of hand, the local sign is different from the pricking of the pin on the palm of the hand By this difference in local sign, the perceiver can determine whether the pin is pricking the back or the palm of the hand Thus the local signs differentiate the whole into the parts of which it is composed, because different parts of the whole come in contact with different parts of the body or sense organ

3 Movement—But the space perception is not possible by mere differentiation of the parts, since a space is a whole and not merely a sum of parts Hence these parts should be spatially related. This is done through active movements To give an example, when a blind man or a man with closed eyes, perceives a table through touch, he moves his fingers gradually, from point to point on the whole table Through these subsequent movements the fingers pass through many points and hence different local signs. Thus the movements relate the different points on the table and a definite arrangement of different parts is established Along with tactual

experience in the movements, there are muscular sensation due to the movement of muscles etc. The series of positions on the table and the series of muscular sensations are experienced together and so they get closely related.

The space is perceived through extensity, local signs and movement. In this spatial perception the role of eyes is most important. It supplements touch and sometimes even supersedes it, though space perception starts with touch. As a matter of fact space is perceived through the co-operation of both touch and vision unless the person is blind.

8

Attention and Distraction

Q 37. *What do you understand by attention ? Give an analysis of its nature.* *(Delhi 1966)*

Ans Attention is a selective process Man lives in an environment The stimuli from the environment are always affecting him. But these stimuli do not affect him equally It is a common place observation that some stimuli affect us more than others. This shows that man selects out of environmental stimuli. This tendency of selection shows that there is a motivational process in him which is known as attention This attention is affected by interest, attitudes and set It is a selective process which includes *motivation, set and selection* *The cat will not attend to the mouse, one* can see a definite set in it This set is both physical as well as mental. To take an example from human beings, if a student is motivated, he will not attend to the class lecture. Again while a professor is delivering a lecture in the class, there are several other sounds beings made in other rooms and the surroundings. The student who hears the lecture selects professor's voice out of the noise *in the surroundings* *While a student is attentively hearing* the lecture, one can very well note his physical set which is also symbolic of his mental set Receptor adjustment, postural adjustment, muscle attention and central nervous adjustments are typical of bodily attitude in attention Thus in brief, attention can be defined as a process which compels the individual to select some particular stimulus according to his interest and attitude out of the multiplicity of stimuli present in the environment

CONDITIONS OF ATTENTION

As a selective act of the mind, attention depends upon several conditions, These conditions may be of two types--External or *Objective and Internal or Subjective* *External or objective conditions* are related with the environment In the environment or surrounding of the individual there are several stimuli, but he does not attend to all of them at the same time, because some sti

experience in the movements, there are muscular sensation due to the movement of muscles etc. The series of positions on the table and the series of muscular sensations are experienced together and so they get closely related.

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very wide background also attracts attention Thus the attraction of an object does not depend upon its size alone, but also on its background. To illustrate, a big black spot on black face will not attaract so much attention as a very small black spot on a white face.

4. Location of the stimulus: The location of the stimulus also affects attention. In the visual stimuli, the most effective location is just in-front of the eyes The role of different pages in the newspapers or the magazine and the different places on the same page, is important in advertisement It has been found by experiments that advertisements given on the front page or on the upper half of any page attract more attention.

5 Contrast of the stimulus: The contrast of the stimulus is also an important determinant of attention e g., the presence of a woman among men and that of a man among women definitely attracts more attention

6. *Change of the stimulus*: Attention cannot be concentrated for a long time on some particular object. Hence the change of the stimulus affects attention Attention is sustained by change of the stimulus The advertisers change their advertisements from time to time lest they may cease to be attractive.

7. Isolation of the stimulus: A man sitting alone in some corner of the park, hotel or club attracts more attention than others. A student sitting alone at the far corner of the class, is seen first Thus isolation is an important external determinant of attention This fact is based upon the reason that the isolated individual is not mixed with other individuals and hence seen separately in his own background. By experiments in advertisement it has been found that only the fact of isolation attracts 30% more attention In the British Journal of Educational Psychology of August 1951, D B Berlyne points out the following principles based upon latest experiments.

(a) In comparison with the un-changed stimulus the stimulus changed in the near past has more possibility of attracting attention

(b) The effect of the change goes on diminishing with the passage of time

(c) Whenever stimuli are changed together and in which one is left un-changed, the effect of change is not noticeable.

(d) If change goes on in the changed stimuli. the process of attention is rather permanent and strong.

ronger than others. The factors making these stimuli, stronger others, are known as external determinats of attention. Be- the external conditions the mental conditions, culture and dity also influence attention. Due to these internal conditions ne objects attract our attention more than others. These ernal factors are internal determinents of attention. The ethods of achieving attention are based upon these external and ternal determinants of attention.

EXTERNAL DETERMINANTS OF ATTENTION

The following are the most important external determinants of attention—

1. *Nature of Stimulus* : Nature of stimulus means its type, *i.e.*, whether it is visual, gustatory, auditory, olfactory or factual stimulus. It has been found by experiments that in comparison with other sensations, form, colour and sound attract more atten- tion. Among the pictures, the pictures of human beings attract more attention than those of animals or objects. Among the pictures of human beings those of beautiful women attract more attention. Besides these, the coloured pictures attract more atten- tion than colourless ones. All these factors are important in advertisement. In the auditory stimulus, the melodious voice attracts more attention than other voices.

2. *Intensity of the Stimulus* : The intensity of the stimulus is a helpful condition in attention. In comparison with the weak stimuli the intense stimulus attracts more attention of the orga- nism. High sound, excessive pressure and acute pain attract our attention. In the market there is always some buzzing sound and yet the pedestrians hear the horn of the motor car, since the sound of the horn is louder than other sounds. But it is not always necessary that one should attend to the intensity of stimulus. Sometimes while walking on the road, calling of our name attracts so much attention that we fail to hear even the loud sound of the motor horn. As a matter of fact the attraction of the attention does not depend on any single factor, but on several factors inter- connected with one another. Hence it can be said that other things being the same, the more intense stimulus will attract mor attention.

3. *Size of the Stimulus* : In the visual stimuli the size of th stimulus is also a determinant of attention. As a general rule t bigger size attracts more attention, but a small advertisement o

very wide background also attracts attention. Thus the attraction of an object does not depend upon its size alone, but also on its background. To illustrate, a big black spot on black face will not attaract so much attention as a very small black spot on a white face.

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The modes of change also influence the process of attention. If there is a change absolutely opposite to the present stimulus, it will definitely attract more attention. While studying one does not hear the sound of the clock or that of electric fan but if either of these suddenly stops, one cannot fail to attend to it. Man becomes used to regular changes and does not pay much attention to them. But if some irregular change or any sudden change occurs, it at once draws attention.

8. *Duration of the stimulus* : As a general rule, the stimulus having more duration, attracts more attention. The duration of the stimulus is an important determinant of the attention But sometimes the smallest flashing of a movement attracts more attention than the bigger stimuli, *e. g.*, a sudden flash of light for several seconds will attract more attention in a dark night than a continually burning lamp.

9. *Repetition of the stimulus* : Along with duration, repetition of the stimulus is also an important determinant of attention. It is a commonplace observation that when the teacher has to attract the attention of students towards a particular phenomenon, he repeats it several times. But sometimes, man ceases to attend a phenomenon simply because it is repeated many times, *e g.*, if a man says some thing about him, we take interest in it once or twice. but if we find that he always repeats the same thing, we cease to pay attention to it.

10. *Movement in the stimulus* : In comparison with the static, the moving stimuli attract more attention The position of stimulus changes due to movements. An object lying in some corner of the room will not attract our attention, but even if there is some illusion of movement in it we cannot help attending to it. The influence of movement in stimulus is widely used by the shopkeepers and businessmen, who advertise through moving electric lights.

Internal Determinants of Attention :

The conditions of attention as described so far are the external determinants of attention They can also be called external laws of attention. The presence of these conditions in the environment is helpful for attention Besides these external conditions, some internal conditions are also helpful in drawing attention. These conditions are related motives As a matter of fact the influence of conditions depends on these internal conditions to a

very great extent The hungry man *will attend to the form and* stimuli of the food. A man with a full belly will not attend to food, however nice it might appear. In the advertisement those demonstrating the naked organs of the woman have the maximum power of attraction of attention. Those intersted in cinema look to the advertisements of cinema at first sight. It is difficult to describe all the internal conditions helpful in attention. Hence only the most important will be enumerated here :

1. Interest : Innate and acquired interests draw the individual's attention to a particular object. Doctors, engineers, professors, *all attend to the object o their own interests.* Even among the professors an object attracting the attention of a professor of geology need not attract the attention of a professor of philosophy as well Thus *the innumerable differences in interests create* innumerable determinants of attention in different men. The stimuli influencing innate tendencies attract more attention than those influencing acquired interest.

2 *Basic Drives* The basic drives or instincts of the individual are also important in drawing his attention. The animal attends to a particular stimulus when driven by the basic drives of hunger, their, sex etc , *e g* , a normal man motivated by sex will naturally attend to individual of opposite sex We all know by experience that when hungry we may attend to even a distasteful object, but while our belly is full, we may not attend even to the most tasteful food Among the instincts, the fear has got a definite influence upon attention All men who fear snake will attend to *all things resembling the snake Like fear, curiosity* also influences attention We attend to even the smallest details of the object about which we have any curiosity

Innate need also is very important in attention The influence of sexual need in attention is very much exploited in the advertisements Normally the sexual need in human beings can be easily evoked Hunger, thirst etc , are felt occasionally and the means to satisfy them are also readily available, but neither the sexual need is ever fully satisfied nor are the means of satisfying it available to all perosns all the time Hence most of the advertisements draw attention by *stimulating the sexual need in human beings*

3. Mental Set Mental set is one of the most importan internal determinants of attention Mental set means the tendency *or attitude of the mind* A man will attend to those objects to-

wards which his mind is set. In the days of examinations, the mental set of students is generally towards the examination and hence even the smallest thing concerning the examination will attract their attention.

4. *Aim*: Aim also influences attention, Every man has some immediate and some ultimate aims *e.g*, the immediate aim of the student is to pass the examination while the ultimate aim may be to get a job to earn living or any thing else. The man whose aim is not to pass the examination will not be concerned with text books or notes etc., but one who has the aim to pass the examination will at once attend to them.

5. *Meaning*; In comparison with meaningless things, meaningful things and talks attract more attention. A man will not attend to a thing which has no meaning for him. Men do not like to hear meaningless talk. If some persons are talking in Tamil, the Punjabi will not like to hear it since for him it has no meaning.

6. *Habit*: Habit is also an important determinant of attention. If a man is habituated to rising early and winding his clock early in the morning, he must attend to the clock as soon as he gets up. It has been rightly pointed out that man learns as to which object he should attend to and to which he should not, and thus develops habits of attending and not attending to things. Thus habit has two aspects in relation to attention. On the one side man develops a habit of attending to necessary desirable things and on the other side he develops the habit of not attending to unnecessary and undesirable things. Both these kinds of habits help man in his daily routine.

7. *Disposition and Temperament*: Both disposition and temperament are important internal determinants of attention, *e.g.*, a man having a religious disposition and rational temperament will attend to religious matters, while another person having a sexual disposition and passionate temperament will attend to matters concerning sex or crimes etc. William James has rightly pointed out that it is our tendency to take interest in particular things, a result of our innate disposition and mental development, that determines at to which among the crowed of sensations, should attract our attention.

8. *Past Experience*: Past experience also affects attention. If we know it by our past experience that a particular person is

sincere towards us, we shall pay attention to whatever he advises us. If we know by experience that he is not sincere to us, we shall not attend even to his most serious advices.

9 *Emotion*: Emotion is also an important determinant of attention. It is a matter of every day experience that we attend even to the smallest fault of the person whom we hate while we do not attend even to the greatest blunder of a person whom we love. A mothe seldom finds faults with her child. The lovers find the whole world singing and dancing and immersed in romance

10 *Social Motives*: Social motives are very important determinants of attention. In advertisements the human figures attract more attention than figures of animals and things The reasons is that man is guided by his social motives The news about altruism, bravery and saving another's life by putting oneself in danger attracts our attention because we praise these qualities Men attend to things concerning their duties because of social motives

Besides the conditions described above, many other factors influence attention Heredity, education and training have a wide influence on attention The family, school, club, class and society of which an individual is a member, do have some influence on his attention. The physical condition, desire, purpose of the person concerned also affect his attention Thus all the factors affecting the personality of a man affect his attention as well As a matter of fact it is difficult to describe all direct and indirect determinants of attention The description given however, includes the most important of such factors.

Q 38 Describe the nature of attention and also its principal varieties *(Bombay 1960 1959, Karnatak 1955, Muzaffarpur 1954)*

KINDS OF ATTENTION

1 Voluntary Attention Voluntary attention (its name is indicative of its nature) is that attention which is willingly directed to an object If, for example, a student attends to his studies of his own account and as a result of any external pressure, his attention will be called voluntary attention An analysis reveals elements of desire and interest, aim and social adjustment in this voluntary attention In the foregoing example the student directs his attention because of particulor aim like the passing of an examination, acquiring knowledge or one of a number of other goals He takes an interest in studying By passing the examination or acquiring knowledge he may be able to support a family or gain

social standing and status. Like other activities, attention, is just another from of adjustment. The difference between the voluntary and involuntary attention is that while the former is secured by the motivating elements in the individual, the motivating elements exist without in the latter case. Thus, when attention is suddenly attracted by a song, the attention is called involuntary.

2. **Involuntary Attention :** As has been explained above, involuntary attention is not only directed by the individual's desire of motivation, it may even be against it. It hinders the process of goal seeking sometimes, not always. If, for example, your attention is attracted by a song while you are studying, your studies will be hindered. Social adjustment is similarly obstructed by involuntary attention. The proper adjustment of a student can be the outcome only of an undisturbed attention to his studies. On account of the fact that one can pay attention to only one thing at a time, the student will not be able to attend to his studies if his attention continually wanders in other directions. Obviously a person forgets his goal owing to involuntary attention and cannot effect his adjustment.

3. **Habitual Attention :** Besides the two types of attention mentioned above, there is a third type, the habitual or non-voluntary attention The difference between non-voluntary and involuntary attention is that the former type is the result of some habit or practice and the motivation is in the individual but the reason for attention in the latter type is in the object. Habitual attention is different from voluntary attention because habitual attention has no need for a desire as the latter does. But continued application of voluntary attention converts it to habitual attention. For example, a student pays voluntary attention to study in the beginning but it is gradually transformed into habitual attention towards reading or writing. Thus the position of habitual attention is in between voluntary and involuntary types of attention.

Actually the above distinctions made in attention are not very clear. The difference between voluntary and involuntary attention is often only just discernible. No attention can be said to belong to any one of the three rypes completely. A scholar has to exercise his desire inspite of his involuntary attention in reading. There is an unconscious desire to pay attention to an object which involuntarily draws your attention. In this way the difference in the types of attention is small though it is of great importance from the psychological viewpoint.

The nature of attention permits of its concentration in only one direction at one time. Direction of attention to two or more objects means either their acceptance as one or such an oscillation of attention between all of them as gives the impression of simultaneous attention. But experiments have proved, beyond doubt, that a person can pay attention to only one object at a time.

Q. 39 Explain fully what is distraction and how you can overcome it. *(A.U. 1659)*

Write a short note on—Distraction

(Poona 1952, 60, Karnatak 65, 64)

Distraction

Ans *Distraction means the dividing of attention or some interference in attention* For example, when one is studying, the sound of a song or noise breaks in upon attention. The object which causes the distraction is called the distractor In fact, broken *attention is not the absence of attention because the distractor is* associated with the activity, often, though not always, and it no longer interferes with the activity

Distraction does not always interfere

Thus the notion that distraction invariably hinders work is misleading, it being seen for example that the labourer produces more when there is music Some labourers, men and women, sing at work in view of this fact Not a few people do their reading and writing while the radio is playing Some people work better in a noisy environment than in a peaceful one Experiments conducted by Morgan indicated that at first distraction caused a drop in the speed of typewriting but it latter became constant Pursuing the work in the disturbed condition increased the speed and it again dropped when the distraction was removed. But distraction in some experiments by Weber caused harm Though it cannot be definitely said that distraction increases the speed of the work, it is possible to say with some degree of confidence that a decrease in speed due to distraction is not inevitable Actually the effect of a distraction on some work depends in no small measure upon the capacity interest, practice, skill and mental set of the worker. *If* the distraction is suitable the speed will be increased but if it is unsuitable the speed will drop Roughly distraction can be divided into two forms

Form of Distraction

1. Continuous Distraction. As the name suggests, it is the

continuous distraction of attention. Some examples of it are the sound of ratio or gramophone played continuously, the noise of the market place etc. Experiments have led to the conclusion that adjustment to continuous distraction takes place quickly.

2. *Discontinuous Distraction* : This type is irregular, being interspersed with intervals e.g., the hearing of somebody's voice every now and then. It interferes with work because of an impossibility of adjustment.

Means of removing Distraction

Some major means of removing distraction are :

1. *Being active in work* : Work in distraction calls for more energy, so that one way of adjusting to it, or removing it, is to become more active in work.

3. *Disregad of Distraction* : The presence of a distracting factor while a man works is no extra-ordinary condition, and so, the best way to remove this element is to disregard it. The distraction is effective only when attention is directed to it, so the in attention, even the most serious distraction, will keep that activity from being interefered with in any way.

3. *Making the distraction a part of the work* : Distraction is an obstacle only when it is distinct from the activity or against it since attention can be focussed just on one object at one time. Therefore another method of making a distraction ineffective is to make it a part of the work. Some people work better when listening to a song because they make it a part of their work. But this approach is very difficult because in this the interests, nature and capacities of the person are involved. It is very difficult to make an uninteresting and contradictory distraction a part of the work.

after perception. Perception is inevitable after attention does not necessarily follow perception. The two are, obviously, intimately related

Fluctuation of Attention

Attention is a mobile or dynamic activity, and it is difficult to attend to one particular object for any great length of time. When attention moves from one object, to another, it is called the shifting of attention But even when the attention persists with one object, it grows more or less This is called the fluctuation of attention

Causes of fluctuation of Attention

The cause of fluctuation of attention were, previous times, attributed to the temporary slackness in the mental activities and same organs *Some psychologists found the fluctuation even* when the muscles had been numbed. The fluctuation was then believed to be due to the changes in adjustment or adaptation Though nothing can be said definitely about the matter soil the importance of the senses, mind psychological state and environmental factors in fluctuation of attention is undeniable

Q. 41. Can attention be identified with interest ?

(Bombay 1960)

Ans Attention is selective act of the mind. To attend to a thing is to concentrate on it by removing attention from other thing. The mind can attend to one thing at a time Hence mind has to select In the selection it is natural that the mind should select such objects in which it is interested This is amply demonstrated in our daily life The boy whose interest is in playing will tend to play while one who is interested in studying will attend to study Hence one cannot attend to the studies by forcibly sitting for it. One can attend to the studies only when one is interested in it Hence the successful teacher tries to make the students interested in their studies

Interest is affective disposition which evokes attention a maintains it Interest is not activity It is a per [illegible] or a mental structure which supplies sufficient [illegible] power to motor activity Interest is sometimes [illegible] acquired In the fulfilment of [illegible] naturally shows interest Thus the [illegible] naturally interested in each other [illegible] interested in grass while the [illegible]

Lion is interested in goat while goat is interested in green leaves. Besides the instinctive interest there are some acquired interests as well, *e.g.*, the scientist is interested in the instruments of his laboratory while they are of no interest to the ordinary layman. Thus individuals develop different interests according to their disposition, attention, economic, social and political status etc. Attitudes towards those things are mostly acquired. The acquired interest *depends upon experience. The interest is directly related with the* emotions and desires. The thing or the individual in which we are interested finds a place in our inner life and we develop it through our emotions towards it. It is not necessary that the interest should be permanent. Things which do not fulfil any permanent need evoke only temporary interest. As the need is fulfilled, the individual ceases to take interest in such subjects, *e. g.*, if a man has to cross a river, he will be very much interested in the boat, but after he crosses the river his interest in the boat will also come to an end. *Permanent interests are related with emotions and sentiments.* They are permanent mental conditions. According to Drever is a disposition in its dynamic aspect. Interest is not an affective experience, but affective tendency. It is not mental process, but mental structure.

According to McDougall "Interest is latent attention, attention is interest in action." As it has already been pointed out, interest is mental structure and it is expressed through attention. When the individual is not attending to a particular object his, interest in it is in a dormant form, *e g.*. suppose a man is interested in seeing a tennis match. Whenever there is a tannis match, he always goes to see it. He reads news about tannis very attentively. But neither a tennis match is played daily nor news about it is heard everyday. Hence when this particular man is busy in the activities other than seeing the tennis match or hearing news about it, his interest in tennis remains latent. When we attend to an object, our interest in that object is manifested. If we are interested in a certain thing we must attend to it. A man interested in national progress will attend to every national issue, A man interested in women will normally pay attention to them.

Interest is a mental cause of attention. It is not necessary that all men should be acquainted with their interests. Sometimes when we attend to a thing, we wonder how we came to be interested in it. Sometimes we do not know as to in which things we are

interested. Sometimes we are not prepared to accept that we are interested in a certain particular thing.

But the innate relation between interest and attention should not mean that one cannot attend to an object in which he is not interested or if one attends to a thing it necessarily means his interest in it. Very few persons are interested in studies. Mostly the students study with the purpose of getting a degree or finding a job by passing through the examination But this need not cause any deficiency in their attention. Even when one is not interested in his studies he can attend to it. There is no correlation between the degrees of interest and attention. As a matter of fact neither interest and attention are identical nor there is a positive correlation between them Interest is a cause of attention, but attention is not a result of interest By saying that there is innate relation between the interest and attention, it is meant that interest is a very helpful factor in attention

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9

Studies of Action : Motivation

Q. 42. Discuss the role played by motivation in the learning process. (*Bombay 1955*)

Ans. In the words of Guilford, "A motive in a particular internal factor or conditions that tends to initiate and sustain activity." Thus motivation includes all those internal conditions which begin an activity or sustain it. Motive is different from stimulus because it is there even before the stimulus. In the absence of internal motive there cannot be any response, however intense the external stimulus may be. The word motive includes all the internal and external factors that initiate an activity. But in psychology motive includes only those factors which control the activity of the living being. It does not include mechanical or reflex actions because they depend on the physical structure and the external environment. Such mechanical behaviour is observed in less developed animals. On the other hand, in the developed animals their changing physical and mental conditions control their behaviour. It is said that the horse can be taken to the water, but no amount of effort can make it drink. Inspite of the presence of the water, the horse will drink only when it feels thirsty. The motives depend on the changing physical conditions and past experience A burnt child dreads the fire because the memory of burning is always present in his mind. Thus it is clear that motivation explains the 'why' of behaviour. Why a certain animal or man behaves in a particular way can be known by an inquiry into his internal motivating factors, Sometimes this "why" can be inferred from external behaviour also. The influence of the sex motive can be inferred by a particular behaviour of a pair of pigeons, The cause of a particular behaviour towards the child shows tender motive in the mother. There can be one motive behind different actions and different motives behind the same action. A man can throw a rupee towards a beggar due to disgust and also due to pity. A soldier can save a person from drowning due to altruistic motive and also to take him to gallows. Psychology explains the real motives behind the behaviour and experience of the individual and living beings.

Motivation in learning :

The motivation has much effect on learning. In the absence of motivation either there will be *no learning or very little learning* and the learned activity shall be forgotten very soon. On the other hand, sufficient motivation will release energy in the process of learning. The motive gives energy for the continuation of the process of learning. It is due to motive that the student goes on studying attentively for weeks, months and you can very easily see the fact of motivation in his activity. He tries to learn cycling with perfect attention and with all his energy. He fails several times and gets cuts and bruises, but he does not cease to make effort If he does not succeed one way he adopts another way. So long as he does not learn cycling, a restlessness is seen in him so much so that he often dreams of cycling. After he learns cycling, he seems to be very happy and is seen cycling now and then, here and there This importance of motivation in learning has been widely utilised in education A good teacher tries to excite motives in the students before beginning some new chapter or before asking *them to learn some new work As he succeeds in doing so, half of* the work is over, because now he has only to guide the child, the rest the child learns himself Learning is a voluntary activity. The more difficult a subject of learning is the more power will be required to learn it and consequently the more motivation is required for it.

Motivation is not only required in teaching, but also in learning for oneself. Hence an intelligent student develops motivation in his studies. By motivation the learning becomes active. In it, the interest and attention are spontaneous, more work is done in less time and a thing learned once is remembered for ever. Motivation has the same place in learning as energy in mechanical function

For the classification of motives see next question.

Q. 43. What are the major classes of human motives ? Explain with illustration. *(Gujrat 1954)*

Classes of Motives

Different classifications of motives have been effected from different view points, *e g*, physiological, innate and acquired, Personal and Social. They have been given different means also e. g., needs, motives, propensities etc The theory of instinct is included *in this* Two types of motives are the most popular—logical and psychological needs, and personal propensities while

the aquired needs account for the social and the learned personal needs.

Woodworth has divided motives into the following three categories :

1. *Organic needs*—Those motives which are aroused by the bodily conditions, *e.g.*, hunger, thirst etc.

2. *Emergency Motives*—Those motives which are aroused when the condition of the environment demands a strong and quick reaction, *e.g.*, the motive to escape.

3. *Objective Motives*—The object of these motives is impressionistic behaviour with people and the objects in the environment. This class of motives is quite comprehensive.

Other psychologists have classified motives under primary and secondary needs, while some classify them as innate and acquired. The latter classification will be the one on the basis of which the following description will be made, because it is the simplest classification.

Internal Motives :

Internal motives are not learned, they are natural. They are the primary, vital, physiological and biological needs, which the person brings with him upon his entry into this world. Their fulfilment is indispensable and of prior importance. They are also necessary for the protection of life. The equilibrium of the body and the mind is disturbed if they remain unsatisfied and it can be restored only when these needs are satisfied. The microscopic cells or fibres of body lead the psychologists to the hypothesis of drives which are internal motor activities.

Specific Organic Needs :

First, mention will be made of the specific organic needs which may be described as animal drives. They are found both in men and animals, the only distinguishing feature being the mode of their fulfilment. Some of the major ones are :—

1. *Homeostasis*—This is a specific organic need, in which the body tries to keep the condition of blood under control, because the equilibrium of the body is disturbed if quantity or proportion of water, salt, oxygen, carbon-dioxide, acid, sugar, protein, fat and glandular excretions is in any way altered. The body is anxious to maintain the normal balance. This balance needs water, oxygen etc., from the environment. Thus, homeostasis is the origin of many activities, in which the nervous system takes part. Many

psychlogical motives, are also conceived in homeostasis. The individual knows the means of satisfaction of some needs while knowledge of other means is supplied by experience and learning. When the person feels hungry due to some biological inefficiency, for the first time, he has not the least inkling of the sense from which his satisfaction is to come But, when once his hunger is satisfied some way or the other, he discovers the means by which he may allay his hunger in the future.

2. *Regulation of temperature*—This is the second specific need of the body The hypothalamus in the brain is an automatic machine which regulates the body temperature so that there is never any very substantial difference Perspiring, trembling, lighting a fire, donning clothes, fanning oneself, installing cooling systems etc , are all perceptible or imperceptible activities caused by the hypothalamus

3. *Sleep* . This is third specific need of the organism, the importance of which cannot be denied The activity of sleeping consumes the individual's greatest share of time. Sleep is the natural reaction of the organism to fatigue and an absence of stimuli. Its centre, too, is the hypothalamus which induces sleep, when acted upon chemically Experiments indicate that a person is not completely inactive in his sleep Generally he alters the posture of the body every twelve minutes or so Sleep is deepest during the first few hours It gradually becomes lighter as time passes. Every person has individual and unique habits of sleep but this does not mean that sleep is a habit If a person stays awake indefinitely his interest and enrgy become lax even though he may complete many of his activities as usual.

4 *Hunger* · The stomach makes some motions when it is empty, which may vary in frequency from 10 a minute to 20 or 25 a minute

Detailed investigations and experiments have shown that there is a close relation between *blood chemistry and hunger*. The reduction of the sugar in the blood starts hunger-sensations, while its excess reduces the hunger If blood is transferred from a hungry dog to another dog, the latter starts feeling hungry But it cannot be said that blood chemistry is the only factor upon which hunger is dependent, because the deficiency of proteins, fat, carbohydrate also results in hunger. Mostly, man or animal demands some particular type of food and not just food, when he is hungry. The

choice is regulated by the deficiency in the body. During pregnancy, a mouse needs about twice the normal quantity of salt. It has been adequately demonstrated by experiment that the animal has not to be told the type of food to be consumed by it. When the feeding was done by the Cafeteria Method, in which the child may eat anything he likes, in any way which he may prefer and as much of it as he likes, the children soon started to pick out the food by mere vision or by smelling. This experiment proves that children develop properly if only they are fed in accordance with their wishes. Generally there is no difference between the food suggested by doctors and food individually selected. The animals, e. g , rats have individual preferences which changes with alterations in bodily conditions. The choice of food is neither by trial and error only nor by the motivation of bodily needs exclusively. The physiological needs furnish a motive for the selection of food by trial and error. Human beings as well as animals eat more if they eat in a collective group. The taste, smell and shape of the food have a marked effect on its selection by human beings. As a general rule habits are important in eating though these habits may be violated under certain circumstances. There are many harmless things which people do not like to eat. The rejection of a particular food by some individual does not indicate that it is harmful for him. In animals too, the hunger may be due to causes other than the biological needs, In experiments on hen it was found that she starts eating merely on the sight of a heap of grain, she stops eating but starts again if the grain is first removed and then replaced. She also starts eating if she sees other hens doing so, even when she has no appetite. A similar type of behaviour may be seen in human beings.

5. *Thirst* : Thirst, too is a specific organic need, similar to hunger. A person is very restless and active if he is denied water for any length of time, even though every other need is satisfied, and this is an unmistakable sign of some deficiency. The throat and the mouth become dry due to the diminution of water in the salivary glands which is the result of a reduction of water in the blood. Consequently, there is a strong desire to imbibe water or some liquid. Due to some social reasons, man does not feel restless even when extremely thirsty. Thirst cannot be definitely or indefinitely quenched by a mere wetting of the mouth and throat. This proves that the cause of thirst is not the dying up of the mouth and throat but rather the decrease in the normal quantity of water

in the blood. The dogs, in experiments, drank the water they needed. This ratio seems to be the result of the balance maintained by the pituitary hormones.

Besides the specific organic needs mentioned above, the excretions of the waste products in the form of perspiration, urea etc., and the need for physical exercises is felt in men as well in animals. They are both important for the body. The physiological needs mentioned so far are of vital importance for the life of creature and are consequently vital physiological motives, and they have their *origin in some organic condition or other.*

Some physiological needs will now be described whose stimuli and the resulting reaction may take many varied forms. A delay in their satisfaction, or incomplete satisfaction need not be of fatal significance for the individual. In case the natural means of satisfaction are not available, other means may be adopted. Some of the more important among the less specific needs are:

1 Sex: Being related to the sex glands, it is an organic need. It is a means of giving birth and sustaining the species. It is known by the seasonal menstrual changes in the female mammal. The manifestation has become very complex in view of the restrictions placed upon men by the society, though its importance cannot be denied. Sigmund Freud, the founder of the school of psychoanalysis, believed the sex motive to be the most important and comprehensive motive of all.

The inception of the sex motive is due to the excretion of a gland. In the male it is caused by the excreation of the sex glands, while in the female due to the ovaries. The circulation of the blood carries it to the brain, the resulting behaviour being of a type not normally observed. The normal activity due to this *motive is an* interest in the members of the opposite sex, and a particular type of behaviour towards such, the goal being the mating of the male and the female. In the lower species, the sex activity is related to the seasons, being the highest in spring when the daylight is of a longer duration. The light has an effect on the brain via the eyes, and it excites the excretion of the pituitary. This excites the sex instinct.

2. Maternal behaviour—Maternal behaviour is a symbol of the love and affection a mother has for her child. It is believed that this form of behaviour is the consequence of a pituitary excretion, the prolactin which affects the brain and causes specific type of behaviour in the mother towards the child. She makes many and

varied attempts to protect and look after her children, to get near them when they are separated from her. Prolactin, when injected, created maternal behaviour in a hen who had no chicks of her own. It is seen sometimes that the behaviour of the female towards her children is not exemplary. She deserts and sometimes even devours them. It can not be concluded from this that the maternal drive is completely absent but all that this indicates is that there is a more powerful motive at work in the female at the time. Another reason for this extra-ordinary behaviour on the part of the mouse may be the deficiency of some material, a deficiency capable of being removed by the eating of the offspring. A mother, fearing disgrace or pursuing some other motive of prudence, may abundon a child without it being essentially assumed that she has no maternal love or that she is indifferent towards the parting.

The maternal behaviour in animals as well as birds presents many complex activities. Maternal behaviour, being similar to sexual behaviour in as much that it is innate and that it has a definite pattern in the species, is not the only aspect because the existence of the maternal instinct may also be accepted. The maternal behaviour becomes more specified with every increase in the level of development in species.

Maternal behaviour in human beings

Maternal behaviour is compared with sexual behaviour because the presence of the maternal instinct is as unacceptable as the existence of the mating instinct. Besides, the existence of such an instinct is not clearly proved. A desire for children before they are born is one thing and their care and a love for them after they are born is another. In the present age, many educated, prosperous women consider children a mere burden. And if, in some way, a desire to give birth to a cuild is conceived the care of the child is entrusted to a nurse. Consequently, the desire for children, in women, is not universal and neither is the desire for their care. Nearly 75% of the 87 pregnant women, who were subjects in an experiment in U. S. A., replied in response to a question that they were not happy at the prospect of having children. About 66 percent of another group of 66 pregnant women confessed that they had no plan about their children. The very substantial dissimilarity between the Indian and the American culture does not admit of the application of these experiments in identical form in Indian conditions. But if the westernized Indian ladies are the subjects of the experiments, the

results will not differ to any great extent. If the element of culture is eliminated, it is unbelievable that the maternal behaviour is innate or instinctive. This fact is further strengthened by the fact that there is an intimate connection between maternal behaviour at an adult age and doll playing in the childhood. Many women have children because their husbands want them to other because they feel it a necessity, while other women feel that a childless woman is looked down upon by the society. Some women procreate because they feel that it is conventional. Those women who have children purely because they were motivated by the maternal instinct are not many. Another proof of the absence of the maternal instinct in women is the fact that many children are devoid of the indispensable love of their mothers. On this point, there is a great difference among them The patterns of maternal behaviour vary with the culture and the individual, a major part of which is learned. The girls learn their maternal behaviour by observing the behaviour of their parents and by playing with dolls, and even then there are very few successful mothers. In reality, the maternal behaviour in human beings is learned to so great an extent that it is difficult to accept it as motivated or instinct originated.

General Needs

Apart from the needs detailed above, there are some internal needs which are common to living beings Woodworth calls them emergency motives, but they are also called general needs The major ones are—Escape, Combat, Mastery motive etc.

1. The urge to Escape—The urge to escape is natural in danger when there is a possibility of physical damage This urge is active in a dangerous situation We jerk our hand away when it is pricked and similarly, an animal shrinks his foot if it steps on a thorn. The tortoise withdraws its neck back into its shell on the slightest noise. The natural reaction to danger is the preparation for protection against it

The signals of approaching danger are of importance in the urge to escape These signals are different for different animals and are received from diversified sources They are innocuous and the danger lies in the comprehension of their meaning. An interesting experiment was carried out to test this A nonpoisonous snake was given to people to touch. Children below two years did not show any fear while three-to-four-year old ones tried to get away from it Older children ran away from it and college

students definitely exhibited fear. In this way, children do not fear many things of which the elders are afraid.

The meaning of these indications is learned either by association or by controls. Besides association, children feel frightened if they see their elders similarly afflicted. There is a famous experiment conducted by Watson on this subject. A one-year-old lad named Albert played with white rabbits, dogs or rats fearlessly The boy was frightened by the noise of a hammer stricking an iron rod just as experiment. The boy stepped back in alarm. When this process was repeated over and over again the child becmae frightened of the white rabbit, and started running away from it. He was so such affected by this incident that he started running away from the dog too. The conditioning in understanding the meaning of the danger is quite obvious. The child associated the noise with the animals and took the animals to be the signs of the danger. Comparatively more intelligent children did not associate the two. The hen screeches loudly on perceiving the kite and hen chicks are scattered. In the human beings too, a similar phemenon may be observed. It is amply illustrated by the crying of the child who has seen his mother crying and screaming. The children learn to be frightened by lightening, rain or storm from their frightened elders.

The fear so learned gradually takes root in the mind of the child and becomes difficult to eradicate but sometimes it is the same conditioning that is used to remove these groundless fears. For some unknown reason a small boy. Shiboo by name, was frightened of rabbits. The fear was removed by conditioning. The experimenter placed a caged rabbit at a distance which did not disturb the tranquility of the boy and induce him to abundon his supper. The cage was gradually pushed nearer till the cage was very near the boy and when he got used to the spectacle the cage was dispensed with. Then the boy started playing with the rabbit even when he was not eating. The boy thus ceased to associate the rabbit with the interesting condition of eating and forget his fear. This activity of fearing due to association is comparatively more in the young than in the adults because they do not associate any and every object with fear An adult does not run away at the sound of an engine and neither does he associate, like a child, any noise with any object. But on the other hand, an educated and grown up person, by virtue of his understanding sees danger in objects appearing harmless to the uneducated or the child. There

is no organ or gland which may birth to fear. Some parts of the brain, do, of course, act in a fearful situation but the stimuli are generally external These stimuli include the possibility of pain, injury or some other damage

The means of escape to which a person may resort are not the same. To take an example, some people daydream in order to escape from danger, and they do so through the medium of imagination. The person afraid of other people in society begins to love solitude Some people become ill when they want to avoid some stern duty This method of escape is employed by soldiers, because some of them become ill as the danger of proceeding to the war makes itself manifest.

2 *Combat Motive*—This motive is universally applicable. Its strongest stimulus is resistance. Commonly it is a normal experience that if you approach a cat, she runs away from you, but if all the avenues of escape are blocked she will bare her teeth and perpare to attack If you restrain the movements of a child by holding its hands, legs, head, etc , it will go red in the face, screaming and struggling. Remove a chick from the hen, make fun with an irritable person or obstruct the culmination of the motive in an animal and the struggle will start Usually the struggle is a reaction to the obstruction in the fulfilment of the motive.

The aim of combat is to remove or overcome the obstacle. An internal, physical and emotional confusion persists till the person either gets rid of the obstacle or overcomes it. The pattern of the struggle or combat does not conform to any rules and is therefore dissimilar in people. The same rule applies to the instruments used in action The animals with long nails find in them admirable instruments or weapons for attack or defence. Usually, it is the male who does the fighting He fights with members of other species and fights with members of his own group for the female or for his own food. The excretions which are the specialities of the feminine, probably suppress the element of combat Some animals and men threaten before they fight. The monkey's threat is famous. Some animals achieve this by showing their teeth, others by screaming, while still others do it by thumping on the chest. Age, intellect, social and cultural factors alter the methods of combat A civilised man manifests his combative tendencies indirectly. His enemity continues over the years and he adopted indirect methods in revenge. One form of combat, which is very popular or common in civilized societies, is the

fighting of cases in law-courts. It is difficult to accept combat as insinct, drive or an internal motive whose sole aim is fighting. The tendency of competition may be innate but combat is usually seen actively when the fulfilment of a motive has been hindered. Combat is the result of anger but sometimes anger is expressed in some other way. An employee, rebuked by his senior cannot talk back to him for fear of loosing his job, so he gives vent to his anger on his wife or children. Our tendency to combat is sometimes excited by the sight of others fighting. Playing or watching a game in progress or boxing in films are all outlets for the tension of combat. In the family, the parents restrict many tendencies of the children thus generating a feeling of ill-will in them, due to which the children worry the parent who feel disgussted with their children. Brothers and sisters compete with each other for the love of their parents. In the same way, the husband and wife also quarrel on some point or the other. A harmless outlet for these tensions is necessary to preserve the peace of the family. Play is adequate for the children. The elder people should be given an opportunity to have their say because it is better to get it off their chests.

Besides in motives mentioned above curiosity, play, humour etc., is innate behaviour.

Other Innate Motives

3. *Curiosity* : This is a fundamental motive which has no particular bodily base. When a creature is confronted with an unfamiliar object, a desire to know or understand is naturally generated. In human beings, besides the tendency towards curiosity a feeling of surprise or curiosity is also observed. Everybody has a desire to know new things and see new places. A child, given a new thing, will turn and twist it to gain some knowledge of it. A child is always ready to ask questions are endless. You may reprove him because you are tired of his questions but he will never be exhausted on this account. If the child's curiosity is not repressed, he will continue his search till he has acquainted himself with his surroundings. These are the children who become great inventers, scientists and explorers if they preserve their curiosity tendencies to adult age. This is an important motive from the bilogical point of view. It makes the creature become familiar with his environment.

4. *Urge to play* : As a general rule, the urge to play is present in almost everybody. It is an innate tendency which has no specific centre in the body through it does depend upon the general

condition of the body. A tired or convalescent person does not relish the idea of engaging in a game. The desire to play is felt only when the person has adequately rested and is healthy. A game is played when the person has enough energy and is not forced to expend it on some activity related to his livelihood. Children like to play more than the problems of life to struggle with.

The pattern of playing varies with the culture or the race and with the individual in the race. Some of the forms which playing takes are jumping, chasing, catching, fighting, sexual behaviour, construction and turning and twisting objects. Often, children are seen copying their elders at play. It is incorrect to interpret this to mean that games are a means of preparation for older life. Games definitely assist the activities of older life by strenthening the tissues and making them efficient to carry on some activities But it cannot be accepted that games aim at the preparation for the life in future The fundamental motive is the need for physical exercise and it may by expressed in any form, *being directed by the environment in its expression. The tendency* to gain superiority or the sex drive may by the alternative causes for the urge to play

5 *Humour or laughter* · The tendency to laugh is nearly universal in people, and it is a special tendency present in human beings only The action of laughing in people does not vary very much but the mirth raising situations do vary with the individual No rule can be laid down to state the incident capable of raising laughter in a certain person. Some people are amused if they see some person slipping on a banana skin or people falling in a cycle accident or horse-carriage overtuning, while other people may see nothing funny in these incidents Bus leaving aside individual perversions, there are some things on which people generally do laugh. For example, we laugh at another person's mistakes, or *we are amused on perceiving another in an embarassing position.* It is not uncommon that boys laugh when the talk of girls who, in their turn not harbouring any charitable feelings for the boys, laugh at the expense of the boys Grownup boys and young people are *vastly amused* by sexual jokes It is seen sometimes that people laugh more at broad an indecent jokes Psycho-analysis give it as their considered opinion that such type of talk being prohibited and suppressed by society a tension is created the slackening of which on hearing such talk, leads to laughter. This does not lead one to say that every type of humour is a safety value for the evacuation of

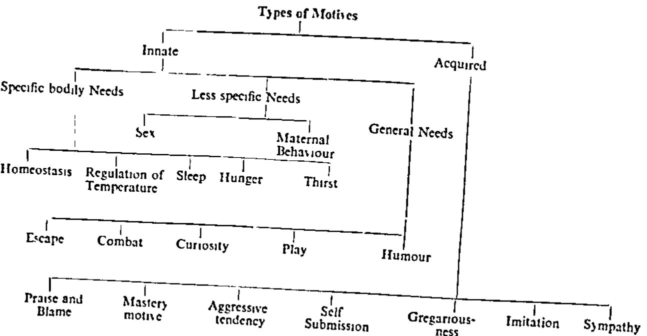
an Indian is comparatively less active than a member of the western society.

3. *Aggressiveness*—This is an expression of the mastery motive. There is a great diversity in this tendency which is the result of the different existing ideals and rules in a society. In India, for example, the Nagas are a blood thirsty tribe who are called Head-hunters while many other Himalayan tribes are very peaceful. In a civilised society murder is considered a wrong and no woman marries a murder but among the Nagas it is that person who does not cut heads who finds it difficult to find a bride. The Arapesh tribe of New Guinea discourages the aggressive tendencies, while on the other side, the Mundugumors encourage it from childhood. Therefore, the aggression tendency, like the mastery tendency, cannot be accepted to be innate and universal. They are required tendencies whose existence depends upon social conditions.

4. *Self Submission*—Some people have accepted as natural the tendency of self submission, as opposed to that of self assertion. Undoubtedly, the child has many occasions for self submission, being helpless before his elders. These childhood impressions are important and lasting but it is correct to call the submission tendency a learned tendency because it is usually learnt in the family or the society. Being comparatively weaker, women have a greater tendency to self submission but in some South America sea islands the women are the leaders and the men follow them in political and economic matters. Thus, this tendency depends on the social pattern. It varies in degree in different persons, and it may even be completely absent.

5. *Gregariousness*—This tendency makes a person want to live in a group with the rest of the tribe. This tendency is expressed in the form of herd behaviour in animals. For this reason, goats and sheep live in flocks, though this tendency is not present in all animals. Thus it is neither internal nor universal; and also not self generated. This gregarious tendency is not found in every person. While many people line in group there are some who detest. This tendency is in reality, learnt, which includes the advantages of a society. The person gets food, drink, accomodation easily, in a group, and he is enabled to satisfy his many tendencies.

6. *Imitation*—Though imitation is seen very much in the human beings it is not compelling. Even if the existence of any such instinct is given credence its field is very limited. It is


Types of Motives
Innate
Acquired
Specific bodily Needs
Less specific Needs
Sex
Maternal Behaviour
General Needs
Homeostasis
Regulation of Temperature
Sleep
Hunger
Thirst
Escape
Combat
Curiosity
Play
Humour
Praise and Blame
Mastery motive
Aggressive tendency
Self Submission
Gregarious-ness
Imitation
Sympathy

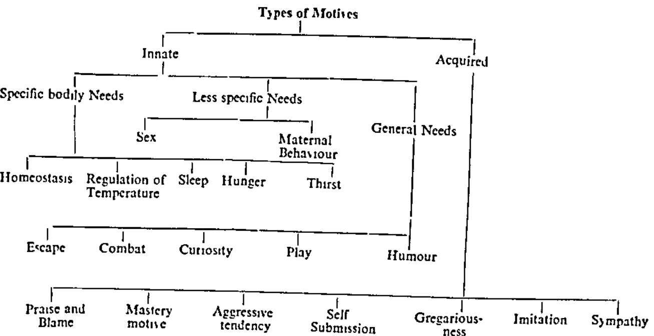
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common knowledge that a child learns his activities, habits and behaviour by imitating others, sometimes imitating grownups *without a knowledge of what he is doing.* The *power of imitation* is stronger in humans because they can make more minute distinctions. It is not necessary that he may observe all the details or that he may imitate immediately but imitate he does. Imitation is very important in human learning. Some birds give a very good imitation of voice but others do not have this quality. This tendency varies with the power of imitation in the animals.

7. *Sympathy* ; This is an experience of another person's emotional response. Seeing another person in serious trouble a sympathetic person experiences a similar, though less intense, feeling, Some people cannot keep back their tears when they see another crying. Some people are seen crying for hours upon seeing a tragic story on the cinema screen. Take a look at the ladies coming out of the picture house after seeing a tragedy and you will see marks of crying on most faces. But this reaction is not seen in every one. Some people laugh, not only at people in pain but even when they are causing grave pain to others. The news of the death of hundreds of people in Germany makes you curious but even the death of a distant relative makes you unhappy. Why is it so ? Actually, sympathy cannot be said to be innate. A major part of it is conditioned respose while the remainder, too, is in some way a learned motive.

10

Frustration and Conflict

Q. 44 What is meant by frustration ? What are its sources and forms of reaction ? *(Agra 1964)*

What is Frustration ?

Conflict with various factors in the environment in search of satisfaction for his desires is a normal condition of human life. No man in the world can entirely fulfil his desires. Failure in the *satisfaction of some desire is normal in every person's life, and the* path of satisfaction of most of our motives is marred by obstacles and troubles Naturally, our desire or motive remains unsatisfied on this account Frustration is the natural consequence of such difficulty. It is a kind of state of hopelessness and disgust. It destroys the person's enthusiasm, his tension in life is increased, and sometimes he becomes the victim of complete despair. Hence, frustration is a mental condition which is resultant upon our failure to satisfy some motive or the other. Main features of a frustrated state of mind are—extremity of tension, sense of inferiority, lack of peace, and various kinds of mental mechanisms

Various Reaction to Frustration

Reactions to frustration also succeed in elucidating its nature. *Main forms of reactions to it are the following* :—

1 Creation of or increase in emotional tension—A child is naturally and very strongly motivated and inclined to go out of the house and to play with other children of his own age. If he is [illegible]

this expression can take the normal form or instead it can be manifested through different kinds of mental mechanisms.

2 Increase in effort—*A healthy person's reaction to frustration* is in the form of increased efforts towards overcoming the obstacle causing the frustration For example, if a student fails to secure good marks at one of the terminal examinations, then,

instead of being completely discouraged and deprived of the will to try, he redoubles his efforts so that success in future may be made possible, and often this does come to pass. Actually, when frustration falls to a person's lot in life, then he should think upon the causes of that frustration, since it is not essential that the frustration is inevitably the outcone of a low degree of enterprise in the individual. It is possible that the work he is trying to perform is outside his capability, as not many students succeed in studying a subject that interests them not. But if the failure to attain a goal is the result of our lack of effort or enterprise, then the best one can do is to step up the effort, in complete disregard of the frustration suffered.

3. *Different approach*—Another cause why frustration dogs our footsteps in life is often the choice of a wrong method of approach. For example, many of the students are not aware of of the method of study that should be adopted for scoring well in an examination, as a result of which they fail to do it, despite their best, concentrated effort. If frustration is the outcome of such faulty orientation, then success can be had for the asking in the future by changing one's method of approach, and quite a number of people intuitively realize this fact. When a sensible man fails to attain his objective through one approach, he immediately tries another, and in this manner sticks to trial and error till he discovers the one correct method of action.

4. *Change of objective*— On the other hand, when some people fail to obtain their object, they avoid frustration in this line by changing their very goal. And the goal can be changed in the following ways : first, by reducing the objective and aiming at a lower level, and second by entirely adopting a different goal. For example, every student who chooses to study has not the capacity or ability to stand first in an examination; hence if all of them have this object then frustration is only going to be naturally theirs. When this does happen, some students choose to aim at the second division while certain others aim still lower and choose only to succeed at the examination without talking in terms of merit. Frustration is thereby avoided. Other students may even lose their interest in academic pursuit and turn to trade and commerce, where success may or may not meet them.

5. *Feeling of Inferiority* ·All the reactions to frustration mentioned so far are simple and straight forward, and can be seen

in a large majority of individuals but there are certain other reactions that are more indicative of abnormal behaviour For example, when frustration meets certain people they not only refuse to change their method but also their aim, in other words, they do not accommodate themselves, and, instead, get into the habit of regarding themselves as very weak and helpless, hapless and unfortunate. *A tense mental state of this kind is called the feeling of* inferiority. A person full of the inferiority feeling looks only to his own shortcomings and is always afraid of inviting criticism from and disregard of others Mental characteristics such as suspicion, jealousy, criticism of others, anxiety, introvert tendencies, fear of competition, high emotional excitability towards criticism, very profound reactions to failure, etc, are to be seen in his life This sense of inferiority is not caused by actual deficiency of interests and abilities in the individual. It has instead been seen that many unintelligent students do not allow this sense of inferiority to step near them, and despite repeated failures continue to make gorgeous plans of the future, while on the other hand many very acutely intelligent students develop a sense of inferiority even on the slightest failure *Thus, the sense of inferiority is a* concomitant not of capacity but of character. Very highly ambitious people have very many frustrations, and thus their sense of inferiority once it is developed is also strong For example, when a student hopes to get a first division and gets a second instead, he is beset by the feeling of inferiority, whereas other students feel very puffed up merely because they have succeeded in passing the examination.

Consequently, it can be reasoned that in order to avoid the sense of *inferiority away from him the individual should first of* all try to aim at something that is within his own capabilities to achieve, and secondly he should spare no effort to attain this end There is a proverb · Know what you can do and do it like a Hercules Success does not come easily when one does not know what one is capable of or one does not pursue an objective with all the ability at one's disposal, after one has become sure that it is within his capacity. It is this simple formula of success that led some common men to the most coveted and revered positions in the world Ram Murti, a famous wrestler, was a lean and thin person in his youth, and it was through rigid application and continued effort that he became a great wrestler Helen Keller was born blind and deaf but through her indomitable courage and unconque-

rable will she became a wonderful writer and a fine orator, besides becoming a symbol of these qualities for all the world to look up to and emulate. It is evident from these examples that the sense or feeling of inferiority is not bad in itself since it can conceivably spur the individual to great and immense effort which may bring him great success But if this healthy reaction towards the inferiority feeling does not take place, then it develops into a very harmful mental complex as a result of which the individual becomes abnormal and a mentally diseased person.

6. *Aggressive behaviour*—Often, the reaction to frustration takes the form of aggressive behaviour. It is proverbially said that the bad worker blames his tools since he wants to transfer the blame for his failure to the tools. It is observed commonly that when people are scolded in office for their inefficient work, they work off their steam and chagrin by being angry with the children at home. When in an aggressive mood, sparked off by frustration, an individual can, directly or indirectly, launch an attack on others, but in quite a large majority of people this wrath turns in upon themselves rather than on other people or objects. They take to beating their heads with their hands or banging it into the nearest handy wall, while the more disturbed go to the extreme of committing suicide. It is because of this close intimacy between frustration and aggressive behaviour which has been observed that some psychologists have cited frustration as an important cause of war, and they have further suggested that if wars are to be eliminated from human society, then such conditions be created in which frustrations of every field of life be at their minimum possible. The most dangerous forms of aggressive behaviour are the consequences of sex frustration. Such a fact is borne out if we study the life histories of notorious master criminals.

7. *Mental mechanisms*—Sometime the reaction to frustration is evident in the form of mental mechanisms, the main ones being fantasy, compensation, identification, projection, sublimation and rationalisation The following are their examples :—

(i) *Fantasy*—Any motive of a person that is frustrated in the actual world is satisfied in an imaginary world through the medium of fantasy.

(ii) *Compensation*—When people are frustrated in their desires in one direction, they compensate for it by attaining success to a pre-eminent degree in other directions. An ugly girl, for example, becomes very learned and scholarly.

(*iii*) *Identification*—Many people who find no success in their lives at all, find satisfaction and pleasure in identifying themselves with different great people and with their children whose success brings them the sense of having themselves succeeded.

(*iv*) *Projection*—When frustrated, some people avoid its consequences by projecting their own shortcomings upon others, and by holding them responsible for their failure. Many students console themselves, for failing at examinations by blaming their teachers and the educational system in general.

(*v*) *Rationalisation*—Again, the consequences of frustration are by-passed by certain other individuals who, instead of probing the cause of their failure, choose to put forward convincing reasons and arguments for their failure to succeed.

(*vi*) *Sublimation*—When frustration comes to the life of certain other individuals they choose to turn into directions accepted and credited by society, and thus find satisfaction for their motives. For example, the consequences of sexual frustration can be avoided by turning to the study of various fine arts.

Sources or Causes of Frustration :

Having gained a fair working knowledge of the nature and consequences of frustration, it is now possible to pursue analysing its sources or causes The main causes or sources are the following :

1. *Objective beyond one's power*—As has been pointed out, for achieving success it is essential that the individual's objective should be within his power and capacity. Many people pose before themselves objectives that have no regard of their actual capability and are outside their reach As a consequence their life becomes a tale of frustration and woe, and they always appear disconsolate, anxious, irritable and disturbed Here it is necessary to understand that according to psychology every individual can not be made into anything Hence, an individual should take care to select an objective and aim that is within his power, and having done so, should exert himself to the very utmost

2. *Lack of requisite effort*—But when frustration meets some effort of ours it should not be taken for granted that it is outside our power, since the failure may be due to lack of necessary effort, or due to a wrong approach and defective methodology. These difficulties can be overcome with ease

3. *Competition*—Frustration would have been an unknown phenomenon in human life if every pleasure and all the good

things of life had been freely available, as are water and air. But this is not the condition with regard to most physical perquisites. There are very many things and qualities such as wealth, money, land, property, beauty, attractive personality, great character, fame etc., in which there is not enough of it to go round, as the saying is. The desire to possess them is present in every individual, and a degree of cut-throat competition exists between *all* people for them. Frustration and failure comes to many in this unequal struggle, and bliss only to a very few.

4. *Social and cultural obstacles*—Another very fundamental cause of frustration consists in the taboos inflicted upon the manifestation of our motives by society and culture. In his book *Civilization and its Discontents*, Freud, the famous psychoanalyst, has shown how man has had to pay the price of civilization in terms of frustration and mental agony. And among the various social and cultural taboos the most effective and the most powerful is the one concerned with sex instinct and its manifestation, and Freud has indulged in a detailed consideration of the mental aberrations and abnormalities resultant upon such restraint. Anthropologists have found that fewer frustrations are to be seen in the popoulatin of ancient tribal people in which social and cultural taboos are fewer than in the allegedly more civilized societies.

5. *Physical causes*—Man exist, in a physical environment upon the machinations of which he has little control ; hence such physical Phenomena and events as flood, plague, earthquakes, excessive rain, drought, etc., are some of the sources of frustration in man.

(6) *Political causes*—Every human individual is part and parcel of a political organisation, and the manifestation of many of his instincts is controlled and limited by the state. Hence, the result of this control is evident in the frustration of numerous motives that would otherwise have been satisfied.

Frustrations arising from the above sources can be simple just as much as they can be complex. Simple frustrations are very much a part of every person's life, and are often a spur to one's activity since they increase our enthusiasm to achieve some end that is eluding us, but the arising of complex frustrations can lead to a person becoming tendencious towards abnormality and mental disease. Such states and calamities can be avoided if we try to

keep a sane and healthy outlook on these *frustrations. And the* first step towards such a healthy and sane outlook is the clear realization that frustration is a natural and inevitable part of human life. Many thinkers have gone so far as to opine that *frustration is essential if success is to be attained and prosperity* achieved. Secondly, when a frustration thrusts itself on our mind we should consider it with a cool mind, search for its causes, and make an effort to get rid of them. In this manner we can evade the worst consequences of frustration.

Q. 45 Write a short note on Mental Conflict.

(Gorakhpur 1963)

What is conflict :

Most of man's activities result form motives. Often, more than one motives arise in the person simultaneously, which originate a doubt in his mind and cause tension. He finds it difficult to decide on the mode of action, the state being psychologically designated 'conflict'.

Causes of conflict :

There are two main causes of conflicts :—

1. *Environmental obstructions*—Many hinderances in the environment create conflicts inside the person.

2. *Personal deficiencies*—The deficiences of the character, nature and personality of the person himself create conflicts between the motives. In reality, the existence of conflict in life is indispensable, without which development is not possible, but when these *conflicts assume abormal proportions they become* harmful

Types of Conflict

The major types of conflicts are as follows :—

1. *Approach-Approach conflicts*—In this type, both the motives engaged in the conflict are such that the individual accepts them both and would like to fulfil both, the conflict arising from the fact that both *cannot be fulfilled at the same time* A *person,* for example, wants both a pantaloon and a blanket but has money enough only for one.

2. *Avoidance-Avoidance conflicts*—In this case both the motives are of such a nature that the *individual would* avoid *them* if he could. For example, neither does a person want to work nor would he appreciate being called a malingerer.

3. *Approach-Avoidance conflicts*—In this type the motives

which conflict with each other are such that one of them the individual wants to fulfil while the other he wants to avoid. For example, a player would like to participate in a game but would also like to avoid injury.

4. *Double Approach-Avoidance conflicts*—In this class of conflicts although the person has come to a decision in one direction he still feels an inclination towards the other allurements, although he cannot alter his decision.

Excessive conflicts indicate weakness of determination. Strong will-power is needed to avoid or to be rid of it.

Q. 46. Describe the theories of visual sensation.

Visual Sensation :

Visual sensation is received through the eyes. When a certain object is presented before the eyes, light undulations rise from it and fall on the eyes. There are some chemical and physical actions along with the light undulations under which we get the visual sensation of that particular object.

Aspects of visual sensation :

Three aspects which can be seen in the whole process are given below :—

(1) Physical aspect—According to physical science, every object reflects a special kind of light in a special quantity. The physical aspect of the sensation is formed by these light undulations or the visual stimuli.

(2) Physiological aspect—As has been said before, when an object presents itself before the eyes it brings about a chemical change in the eyes which is carried to a special part of the brain for information. For an exampic of visual sensation, these very physical actions, working from the eyes to the brain, from its physiological aspect. The physical aspect can be seen in all the other sensations.

(3) Psychological aspect—Sensation includes not only the physical changes, but it also produces some mental process. This process is the psychological aspect of sensation. In visual sensation, for example, many psychological actions are seen under the mixture and contrast of different colours.

Stimulus of Visual Sensation

As has been said before, visual sensation is stimulated by the

light undulations produced by an object. There are two kinds of sources for the production of this light and they are given below.

(1) Incandescent source—The light produced by switching on the electric light in a dark room is called the light from an incandescent source.

(2) Inminescent source—If there is phosphorus somewhere in a dark room, the light which is reflected from its gleam is called to have an inminescent source of production.

To define the speed of light undulations, physics has presented the undulatory theory. According to it, the light from an object, before it reaches the eyes, becomes refracted while passing through either which produces a kind of vibration in it. On account of this vibration, light is not received in a straight line. It is received in the form of undulation or wave There is seen a difference of length, amplitude and purity in different light undulations. The difference is given below

(1) Difference of length—The length of light undulations is measured with the help of a photometer in a millimicrone unit. There are 100,000 millimicrones in one millimeter.

(2) Difference of amplitude—There is a difference of amplitude in the light undulations along with a difference of length, although uniformity of length does not mean uniformity of amplitude. Different amplitude is seen in different undulations.

(3) Purity—Whereas some undulations are pure or similar, there are other undulations of different length and amplitude and which, on getting mixed together, are called impure undulations.

The difference of light undulations, as explained above, can also be shown in the form of difference in quality, intensity and complexity. Quality is connected with length, intensity with amplitude and complexity with purity

Characteristics of visual sensations

Some of the objects, which we ordinarily see, are coloured and some are colourless. For example, radish is white but in water it appears colourless In psychology, black and white and all the other colour shades falling between these two main colours are counted among the colourless visual sensations In psychology, while studying visual sensations, the cause of difference among them is also discovered

Characteristics of Colours.

From a physical stand point, differenciation in colours can

be made on the basis of their special features, such as their kind, brightness and purity. A description of these special features is given below.

(1) **Kinds of Colours**—According to physics, the colour sensation of an object depends on the light reflected from it; and since the reflected light undulation is of different length under different stimuli, difference in colours is seen through them. How a particular length of light undulation will convey a particular colour sensation is shown in the list given below :

Kinds of Colour	**Length of light undulation.**	
1. Violet	About 390 to 430	millimicrones
2. Blue	About 430 to 525	Do
3. Green	About 525 to 590	Do
4. Yellow	About 590 to 650	Do
5. Red	About 650 to 760	Do

Light undulations under 390 millimicrones in length convey no visual sensation. They are called ultra-violet rays. They produce a kind of chemical action in the eyes. On the other hand, a light undulation of more than 760 millimicrones in length imparts only a sensation of heat instead of a light sensation. This undulation is called infra Red Rays. In this way, the light undulations, having a length of 390 to 760 millimicrones, can be seen with the eyes to possess one colour or the other. The sun light contains the light undulations of all lengths, and, therefore, when they are analysed, they appear to contain all the colours.

Colours are divided into two classes, primary and secondary, according to difference in their kinds; but all the psychologists do not have the same opinion about the colours to be included in one class on the other. Hering has regarded red, green, yellow, blue, white and black as main colours. But most of the psychologists do not consider white and black as colours. On the other hand Helmholtz has regarded the three colours, red, green and blue as the only main colours and yellow colour has been regarded by him to be a mixture of red and green colours. Hering and Helmholtz have both regarded red, green and blue colours as the main colours. On the same understanding, Ladd-Franklin regards the four colours, blue, red, green and yellow as the main colours. Modern psychologists mostly agree with the opinion of Ladd Franklin. In this way, most of the psychologists regard the four colours, red, yellow, green and blue as the main colours and the rest of the colours are obtained by

mixing them. The pyramid formed with the help of these four main colours is called the colour pyramid.

On reaching the white point, all the colours lose much of their brilliance, and on reaching higher up, the colour sensation comes to an end. In the same way, the briliance goes on decreasing in coming down to the black point and the colour sensation is ended *by going down beyond this point. In this way, it is clear that* along with an increase or decrease in the brilliance of a colour, its sensation undergoes a change. The light undulation on blue colour is the shortest and it is the longest on red colour

(2) **Brightness of colours**—It is a matter of common experience that brightness differs in different colours. For example, blue colour is brighter than violet, red colour is brighter than blue and yellow colour is brighter than blue one. In the same way, some yellow colours are brighter than some other yellow colours This brightness of colours is no proportion to their amplitude. It means that a colour will appear more bright with a higher amplitude and less bright with a lower amplitude. For a colour, to appear white, brown or colourless like black depends on the amplitude of the light sensations The amplitude of the light sensation, in getting lower and lower, reaches a point beyond which the stimulus loses its colour and appears black. By increasing the amplitude of the light undulation of any colour, while maintaining the similarity of its length, a stage is atlast reached when the particular colour is lost and begins to appear brown or black.

(3) **Saturation of colours**—Some colours are deep while others are light. The deeper the colour, the purer it is regarded to be. On the other hand, the lighter the colour, the more impure it would be. Impure or opposite light undulations give rise to impure colour stimuli, while saturated or similar light undulations impart sensation of pure colour In other words, if an object produces light undulations of different length and amplitude, its colur will appear to be deep and well saturated

Q 47. ***State and explain the laws of colour mixture.*** *(Poona 1963)*

Colour Mixing—

It is known from many experiments in physics that colour sensations are conveyed even by a mixture of light undulations of different lengths For exmple, it is not necessary that for a sensationt of yellow colour, the undulations from an object must 400

nade on the basis of their special features, such as their kind, ghtness and purity. A description of these special features is en below.

(1) Kinds of Colours—According to physics, the colour nsation of an object depends on the light reflected from it; and nce the reflected light undulation is of different length under ifferent stimuli, difference in colours is seen through them. How a particular length of light undulation will convey a particular colour sensation is shown in the list given below :

Kinds of Colour	**Length of light undulation.**	
1. Violet	About 390 to 430	millimicrones
2. Blue	About 430 to 525	Do
3. Green	About 525 to 590	Do
4. Yellow	About 590 to 650	Do
5. Red	About 650 to 760	Do

Light undulations under 390 millimicrones in length convey no visual sensation. They are called ultra-violet rays. They produce a kind of chemical action in the eyes. On the other hand, a light undulation of more than 760 millimicrones in length imparts only a sensation of heat instead of a light sensation. This undulation is called infra Red Rays. In this way, the light undulations, having a length of 390 to 760 millimicrones, can be seen with the eyes to possess one colour or the other. The sun light contains the light undulations of all lengths, and, therefore, when they are analysed, they appear to contain all the colours.

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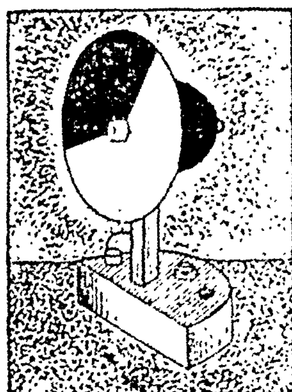
Q. 47. State and explain the laws of colour mixture

(Poona 1963)

Colour Mixing—

It is known from many experiments in physics that colour sensations are conveyed even by a mixture of light undulations of different lengths. For exmple, it is not necessary that for a sensationt of yellow colour, the undulations from an object must be 600

millimicrones. Whatever may be the length of these undulations, if the average length of all of them is 600 millimicrones, it will impart a sensation of yellow colour. It has been seen from colour mixing that, when two different colours are mixed, they impart a sensation of a third colour. Colour mixing apparatus helps to find out this fact in a laboratory. A picture of the same apparatus is given here. As is seen in the picture, plates of more than two colours are joined and adjusted to this apparatus. When the apparatus works, its axis rotates and along with it, the plates of different colours also rotate. When the speed at which the axis is rotating is slow, the colours appear separately; but when this speed is increased, there is seen a flicker in the colours,. If this speed is increased still more, a third colour is seen in place of the flicker. This third colour is the result of a mixture of colours of the different plates. While the axis is rotating, two colours of the two plates stimulate the eye-lens at different places and this is the cause of the sensation of a third colour. This stimulus, working simultaneously, conveys a colour sensation similar to the average of lengths of both the light undulations.



Colour Mixing Apparatus

Laws of colour mixing—

By making experiments with the help of mixing apparatus, psychologists have found out the various laws which tell us how to obtain a new colour by mixing certain colours. Here it is necessary to bear in mind that some colours are complementary and some are non-complementary. A pair of red and green or of yellow and blue is an example of complementary colours. In each pair, each colour is complementary to the other. On the other hand, in both these pairs, any one colour is non-complementary to any one colour of the other pair. In this way, red is non-complementary to blue and green is non-complementary to yellow or red is non-complementary to yellow colour. The three established laws about colour mixing are given below.

(1) A sensation of brown colour is obtained by mixing complementary colours in a particular proportion, the brightness of which lies in the average brightness of both the colours.

(2) If two non-complementary colours are mixed in a particular proportion, a middle colour of both of them is seen The brightness of this mixed colour is the average brightness of both the non-complementary colours.

(3) A sensation of brown colour is obtained by mixing all the complementary colours i e. by mixing red, green, blue and yellow in a particular proportion

All the three laws, given above, about colour mixing can be verified with the help of colour mixing apparatus.

Flicker aad fusion of colours—

It has already been said that if the plates attacked to the colour mixing apparatus are made to revolve in a low speed, the sensations from different colours is separate. This sensation of colours is called the flicker of colours If the rotating speed of the colour mixing apparatus is increased, the flicker gradually ends: and the separate colours get mixed together after losing their separate existence resulting in the production of a new colour having a brightness similar to the average brightness of all the colours thus mixed As has been said before a fusion of complementary colour gives a sensation of brown colour, where as a fusion of a non-complementary colours gives a sensation of a colour in the middle of them. But, when the plates of both the kinds of colours, complementary and non-complementary, rotate at a low speed, there is a sensation of flicker By decreasing and increasing the speed of the colour circle, the point, which indicates the limit of colour mixing, is found out. If the speed, at which the colour circle is moving, is lower than this point, a flicker is seen, but when the speed is higher, the colours get mixed

Q. 48 What is a contrast ? Explain the determinants of achromatic and chromatic contrast *(Poona 1965)*

Visual contrast :

If you keep looking at a colour for a long time, and later begin to look at some colourless object, the colourless object will appear to have the colour shade of the coloured object This psychological process is called visual contrast The main kinds of visual contrast are given below

(1) **Simultaneous contrast**—In simultaneous contrast, as is clear from its name, the sensation of contrast is simultaneous to the stimulus *i e.*, the stimulus and the contrast appear at one and the same time. There are two forms of this kind of visual contrast.

(a) Simultaneous chromatic contrast—If any two complementary colours are placed close to each other, their brightness increases all the more due to the visual contrast. For example, if a woman is putting on a red blouse with a green sari, the red colour of the blouse and the green colour of the sari will appear deeper red and deeper green respectively. This process is known as simultaneous chromatic contrast. The reason is that each colour in its circumference spreads a complementary colour and if this complementary colour is itself present, the brightness of the original colour is all the more increased. Only the complementary colours, on coming close together, affect each other, is not the fact. Even the non-complementary colours, when they come close together, affect each other, and a colour, formed through the mixture of both these colours, is seen on their sides.

(b) Simultaneous achromatic contrast—If an object of black or brown colour is placed on an opposite back-ground, the brightness of its colour increases because the brightness of the back ground is added to the brightness of the object. For example, if two equally brown circles are placed separately, one on the white and the other on the black back-ground, the circle placed on the black back-ground will appear brighter than the circle which is placed on the white back-ground.

The psychological fact at the root of visual contrast in colour sensation is that, if several stimuli join together to affect the eyes, a sensation of simultaneous achromatic contrast is produced through the inter action of these stimuli.

(2) Successive contrast—Successive contrast, as is clear from its name, appears one after the other instead of appearing simultaneously. The sensation of visual contrast in this is not constant but rises at time intervals. In explaining successive contrast, some scholars point at the unconscious state and the mental waves. In this connection, nothing has been said finally. Successive contrast is also called negative. After image, because the negative after image in this is received a little after the colour sensation. The two kinds of successive contrast are given below :

(a) Successive chromatic contrast—It is a matter of common experience that if an object is placed before us for sometime and then removed, its sensation stays for a few moments after it is removed. This sensation which stays even in the absence of the stimulus is known as after sensation. It has been seen from experiments that when a coloured object is seen for sometime and, after

it is removed, the eyes are cast upon some colourless object, the colour, which we now see, is complementary to the colour of the first object. In this way, if the first object is red, green or yellow, the colour seen after its removal will be blue. This mental process is called successive chromatic contrast.

(b) Successive achromatic contrast—Another kind of successive contrast is achromatic contrast. For example, if the eyes are cast on the ground after looking at a white object, an image of a brown colour will be seen. Similarly, if eyes are cast on a brown back-ground after looking at some black object, an image of highly bright white colour will be seen.

Retinal Colour Zones .

It has been found out through various investigations about different colour sensations in psychology that every colour has its own field in the eyelens, although these fields may not be separated from one another completely. These various colour spheres have *individual specialities and are differently impressed by the form*, purity and brightness of the stimulus The instruments, known as Campimetre and Perimetre, are used in studying the colouer spheres It has been found out through experiments that all the *colours of all the parts of the eye lens can not be seen Sensations* of particular colours are received from particular parts. For example, brown and white colour sensation are received from the outer part of the eye lens, blue and yellow from the middle part and all the colour sensation's are *received from the central parts of the* eye lens Outer and middle parts do not convey any other colour sensatious except these definite colours It does not mean that, if a particular colour is presented to any such part of the eye lens which is not *stimulated by that particular colour, there shall be* no stimulation of any kind Many important facts have been discovered in this connection by Baird in his studies It has been found out that red colour appears yellow in the middle of eye-lens and brown in the outer part. *It this colour is taken from the* outer part to the centre, it gradually appears yellowish, yellow, orange yellow, yellowish orange, orange red and red in the end. It is clear that a colour in the outer part of eye-lens appears brown and its saturation goes on increasing *when it is gradually taken* towards the centre where it ultimately appears in its true colour.

Positive After Image

Negative-after-image has alredy been referred to while

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Positive After Image :

Negative-after-image has alredy been referred to while

describing successive contrast. Its opposite image is the positive after image. Both the kinds of images are produced after the eye-lens is stimulated. If an object is attentively seen for some time and the eyes are closed, some particular image is still felt with the closed eyes. This image can be positive as *well* as *negative* to the object seen. There is a negation of colour in the negative image; where as in the opposite image, the colour and shape of the remains the sume as of the original object. But this opposite image is momentary and is not possible for all. After a few moments, it changes into a negative image.

Q. 49. Write note on visual constancy. Explain fully the phenomena of colour constancy. *(Poona 1965)*

Visual constancy—

Ordinarily it is quite logical that if an object is gradually taken away from the eye, its size should gradually go on decreasing; and its size should, similarly, go on increasing when it is taken nearer and nearer the eyes. But it has not been experienced always. It has been found out through experiments that, since there is no direct relation between the actual feeling of the object and its image on the eye-lens, its size remains stationary upto a fixed limit. This fact is true, not only about the size but about the colour, brightness and the form as well. It is called Visual Constancy. A description of its different forms will be worth referring here.

(1) **Size Constancy**—As has been said before, a constancy in the size of an object is seen only upto a fixed limit. An object appears small when it is taken away from this fixed limit and appear big when it is taken close to it. Here a change takes place in the image of the eye-lens but there is no change in the visual action.

(2) **Colour or brightness constancy**—Ordinarily, if an object is placed in the sun and in shade, there should appear a difference in its brightness in there two conditions. But it has also been seen that no change takes place in the colour and brightness of an object when it is removed from the sun to a shade. This fact is known as colour or brightness constancy. For example, if you see a crow in the sun and see him again when he has flown to a shade, his brightness will remain the same in both the conditions so far as the visual action goes, although there is a change in its brighthess so far as its eye lens image is concerned.

(3) **Shape Constancy**—Shape constancy means the constancy of the shape of an object like an egg, circle or a square etc. For

example, we can see the tables of different shape. It has been seen through experiments that if a cirucular object is taken away from the eye lens gradually, its shape changes into the shape of an egg, but the object appears to the circular even though a change takes place in its eye-lens image. This process is called shape constancy or shape stability. Thouless, through his various experiments, has proved the stability of size and shape and has also thrown light on psychological causes at the root of this process According to his opinion, even when the image of an object on the eye lens is small, the object does not appear small when it is seen and it is because of the presence of the deformed image of that object. While describing the stability of colour or brightness, psychologists have maintained that the proportion of reflected light and unreflected light is stable in both, light and darkness. This proportion is called Albedo. Because of this albedo, only swan-white is seen in both, light and darkness. In defining the stability of shape, the psychologists has taken the help of the correct test theory of the third dimension although it has not been able to clear the whole thing.

Q 50 Which of the theories of colour vision explains the main facts of colour vision satisfactorily? Explain how?
(Ravishanker 1965)

Or

Examine critically the Young-Helmboltz theory of colour vision.
(Bihar 1964)

Theories of Colour Vision

Different psychologist have presented different theories in explaining colours and none of the theories has been able to define colour sensation satisfactorily. The main theories in this connection are given below

(a) Young-Helmholtz Theory—This theory was presented by Thomas Young in 1801 and Helmboltz supported it in 1860. Since then this theory in known after the names of both the scientists In the Young-Helmholtz theory, red, green and blue are the three main colours *According to this theory, these* three colours are seen, one after the other, in the retina through three kinds of cones as red, blue and green cones Although these three kinds of cones are stimulated by a light wave of any length, *but different light waves of specific length have specific effect on* different cones In this way, *the effect of light waves of 600 millimicrones* on red cones, of 500 millimicrones on green cones and of 400 millimicrones on blue cones is the greatest A sensation also is received according to that cone which is stimulated by a wave of the specific length in the highest degree. For example, when a

light wave of 400 millimicrones is produced, it affects the blue cone in the highest degree and consequently a sensation of blue colour is received. In the same way, for other colour sensations also, the position, in which a specific cone connected with the specific colour is affected in the highest degree, is necessary. Young-Helmboltz have explained the colour less and other colour sensations on the basis of these three cones. For example, sensation of white or brown colour is received in the position when some specific light wave stimulates the three cones in a similar degree. In the same way, a sensation of black colour is received from the light wave which does not stimulate any cone. Sensations of different colours are received when the cones of these three colours are stimulated in different proportions. A colour sensation is received in the same proportion in which the different cones are stimulated by a light wave. The colour cone, which is least affected, has no hand in the colour sensation. According to Young-Helmboltz, there is no cone in the eye-lens for yellow colour. The sensation of yellow colour is received when the cones of red and green colour are stimulated in a similar degree and in a less degree outside the blue cone.

Young-Helmboltz have explained colour mixture, after-sensation, colour contrast and colour blindness in their theory of colour vision. For a complete understanding of this theory, it is worth while to throw a little light on its explanation about these various processes.

1. Colour mixture—Young-Helmboltz have explained colour mixture on the basis of brain actions and therefore it is also called Central Theory. According to this theory, the nervous impulses, originated from different cones, are of one and the same kind. They differ only when they reach the brain colour mixture is, therefore, not the result of any action in the eye-lens. It takes place in the brain. To prove their theory, Young-Helmboltz have presented evidences from binocular colour mixture when red and green colours are presented before an instrument known as stereoscope, at one and the same time, a sensation of yellow colour is received. Similarly, when two complementary colours present themselves before this instrument, the sensation of brown colour is received. This colour mixture is done through the central nervous system. The explanation of yellow and white colour sensations, advanced by this theory, does not appear satisfactory through experience or any process of argument. For example, according to the explanation

of other colours, when yellow and red cone are stimulated, there should be a sensation of greenish red or reddish green, but it is not seen like that in actual experience Thus, when all the three cones are stimulated, there should be a *colour sensation of the shades of* all the three colours i. e. red, green and blue and not of white colour. But this is not seen in experience. In this theory, it has been taken for granted that a wave of any length stimulates every cone, more or less. If this theory is taken to be correct, there should arise sensations of all the colours in all the parts of the eye-lens, but, as has been written before, there arise sensations of only blue and yellow colours from the middle sphere of the eye-lens In this way, according to the Young-Helmboltz theory, the explanation of the colour spheres of the eye-lens is not appropriate.

2. *After sensation*—In the Young Helmholtz theory, both the kinds of sensation, positive and negative, have been taken into consideration. According to this theory, when a certain stimulus affects some specific cone of two eye-lens too much, its colour sensation stays for some time even after the removal of that stimulus. This sensation is called positive after sensaation. There is one defect in this definition of positive after sensation It has been forgotten here that positive after sensation is the result of a momentary appearance of the stimulus. It has been given in the definition of the theory of Negative After sensation that when some cone is kept stimulated for sometime by any kind of wave, its strength is reduced in comparison to other cones resulting into colour sensation similar to those of the other cones For example, if red cone is not stimulated for a long period of time by some light wave, it will get tired, whereas green and blue cones will become more active, and this will result in a sensation of bluish green In brief, in this theory, the definition of negative after sensation is made on the basis of tiresomeness But, in practice, it is seen that a few moments after the stimulus presents itself, negative after sensation is seen. It is difficult to believe that the cones of the eye lens get tired in so short a time

3. *Colour contrast*—Young-Helmboltz have regarded the doubts created with some personal reasons to be the cause of *contemporary opposition. For example,* blue and yellow colours, when they are presented separately, appear to be brighter in comparison to what is seen ordinarily due to past experience In this process, the past experience of the person works unconsciously One defect in this definition of colour contrast is that it has neglected

the fact that a past feeling does not help in increasing the sharpness of some present feelings but only creates an obstacle.

4. *Colour blindness*—According to Young-Helmholtz, the defect of complete colour blindness is seen in a person when all the these cones in his eyes are either absent or have become weak. If a cone of some specific colour is weak or absent, a colour blindness for that specific colour is seen in him. The defect in this definition of colour blindness is that it does not tell us as to why a person, who is blind for some specific colour, becomes colour blind for its complementary colour. According to this theory, the blindness for blue colour should be taken to be the result of a weakness of the blue colour cone. Then how does it create colour blindness for the yellow colour? It is thus clear that this definition of colour blindness is not satisfactory.

It is clear from the above explanation of the Young-Helmboltz theory about the definitions of various visual processes that this theory is not satisfactory.

(*b*) *Hering's Theory*—Keeping in mind the defects of the Young-Helmholtz theory, Hering presented a new theory about the visual sensations which is known after his name. According to Hering, there are six main colours. They are red, green, yellow, blue, white and black. These six colours can be put in pairs of two each. These pairs will be red and green, yellow and blue and white and black. One colour is complementary to the other in every pair among them. According to Hering, there are three kinds of chemical fluids in our eye-lenses, every one of which is connected with the two kinds of colour sensations. In this way, three fluids are found in the eye-lens connected with the colour sensations of red and green, yellow and blue and black and white. Due to these three fluids, the colour sensations of the three pairs connected with them are received. In every chemical fluid, sensation of one colour is received as a result of anabolic process and sensation of the other colour is received as a result of katabolic process. For example, among the three pairs mentioned above, the sensations of red, yellow and white colours are gradually received due to the katabolic process and the sensations of green, blue and black colours are due to the anabolic process. Although all the kinds of light waves stimulate all the fluids, yet this stimulation takes place in different quantities through the light waves of different lengths in different fluids. For example, the light wave, which impresses the blue and yellow fluids, does not impress the

white and black fluid to the same extent. Hering has regarded red and yellow as the hot colours and all the rest as cold colours. He considers the sensation of black bolour as the natural light of the eye-lens. According to him, there is a feeling of black colour in the absence of a stimulus. In Hering's theory, there are three kinds of nervous impulses on the basis of three kinds of chemical fluids. But other physiologists see no difference in the nervous impulses produced in the eye-lens

Like Young-Helmholtz, Hering also has explained colour mixing and colour sphere, after sensations, colour contrast and colour blindness

1. Explanation of colour mixture—As has already been said, Hering acknowledges two kinds of actions in every chemical fluid *anabolic and katabolic. Whenever both these actions take place* together, there is a sensation of brown colour. This is an example of the mixture of cow flementary colours In the same way, Hering has explained a mixture of non complementary colours separately, According to Hering's opinion, when two non complementary colours are placed together, they produce specific action in the related fluids, as a result of which a sensation of the middle of both the colours is received For example, if the green and blue colours are mixed, anabolic action begins in both the fluids, red-green and yellow-blue and sensation of a colour in the middle of these colours is received.

2 *Explanation of after-sensations*—Like Young-Helmholtz, Hering has also explained both the kinds of after-sensations-positive as well as negative According to him, when we see an object, *the synthetic action in it becomes* weak so that, when we attend to some brown or white back-ground after removing our attention from that object, a positive *after-sensation is the result. Hering's* explanation of the *positive after-sensation is not regarded appropriate.* While explaining the negative after-sensation, Hering has said that the tendency to maintain the equilibrium of the eye-lens is the cause of it For example, as has been said before a feeling of colour from the red and green fluids is due to the katabolic action. Now, if the eyes are removed from the red colour and are cast on a brown base, katabolic action according to the tendency of maintaining equilibrium, is stopped and the anabolic action begins, as a result of which, a sensation of green colour from a brown base is obtained Most of the psychologists accept Hering's explanation about the negative-after sensations

3. *Colour contrast*—Hering has explained colour contrast on physical grounds. According to his theory, whenever a contrasting action begins in part nears the eye-lens, we get a sensation of contemporary colour contrast in its consequence. For example, Katabolic action works in a sensation of red colour ; whereas anabolic action works in a sensation of green colour which is close to red colour. On account of the presence of these actions, contrasting among them, a sensation of colour contrast is produced. This explanation of colour contrast does not appear satisfactory according to the contrast explained with reference to the Young-Helmholtz theory given above.

4. *Colour zones*—According to Hering, sensation of all kinds of colours and brightness are produced in the eye-lens because it contains all the three kinds of fluids. White-black and yellow-blue fluids are found in the middle sphere and sensation of blue-yellow colours is felt. In the outer sphere of the eye-lens there is a sensation of white, black or brown colours alone because it contains the fluids of these colours only. In Hering's theory, the question as to how two contrasting actions are produced on the stimulations of only one fluid has not been explained properly. In the same way, even if it is accepted that in a position of stimulation, the receiving cell is weak, it cannot be accepted that it has an anabolic action.

5. *Colour blindness*—As has been said before, Hering has regarded the absence of visual fluids, connected with specific colours, as the cause of colour blindness. This supposition does not explain the fact why some people are blind for white-black. The theory which has been applied to explains the blindness for other colours does not explain the blindness for white-black colours.

None the less, Hering's theory about-visual phenomena ordinarily appears more satisfactory than the theory of Young-Helmholtz and it is a further step towards a proper direction.

(*c*) *Ladd Franklin theory*—After Hering, Ladd Franklin theory about visual actions was presented in which a synthesis of both the above theories was attempted. Ladd Franklin has explained the colour sensations from evolutionary view-point. According to him, receptors of the eye-lens received only white and black in the begining. Then they evolved gradually and reached a stage where even the blue and yellow colours could also be received in the eye-lens. Gradually after this second stage of evolution, red and green receptors were seen in the third stage. In this way,

three kinds of *receptive cells are gradually formed in our eye-lens* through evolution. Ladd Franklin took the help of evolutionary theory in explaining different colour zones of the eye-lens. According to his opinion, the outer zone of the eye-lens developed in the first stage of evolution, middle zone in the second and the central zone in the third stage of evolution There is no colour sensation in the first zone, in the second there *is a sensation of blue and yellow* colours and in the third zone there is a sensation of all the colours. Even in the explanation of colour sensations, Ladd Franklin has maintained the evolutionary view point. According to his opinion, there are four main colours-red and green, yellow and blue, and there are four kinds of chemical fluids similar to these four colours. When an object of specific colour *is presented before the eye lens* a reaction in the chemical fluid connected with that colour takes place and consequently the specific colour is formed. *Then gradually all the different colours get mixed and take the shape of a* new colour. For example, there is a sensation of yellow colour in the presence of red and green fluids. Yellow and blue both together make the brown colour. In the absence of light stimulus there is a sensation of black colour. In this way, Ladd Franklin instead of regarding colour mixture and colour contrast as central, regards them as related to the eye-lens According to this opinion, when a person is in the first stage of colour sensation, he cannot tell the difference in colours. This explanation of colour sensation is not correct. *Ladd Franklin's explanation* about after-sensations and organization is originally similar to Hering's explanation. In explaining colour blindness, Ladd Franklin has said that the colour recept or fluid, which is not developed completely, produces colour blindness connected to it If not even a single chemical element is developed in any person, that person is completely colour blind. A great defect in Franklin's explanation of colour blindness is that it is not proved through evidences

In all the three theories given above about visual actions, only the first i. e. Young-Helmholtz theory is, on the whole, more acceptable, because, in comparison to other theories, very little help from simple concepts has been taken in it. Amendments are constantly being made in this and it will take a little more time to become fully satisfactory

Q 51 Write short note on Purkinje Phenomena. (Poona 1953)

Purkinje Phenomena

A person named Purkinje was the first to discover that by

going from light to darkness and from darkness to light there is a change not only in the cones and rod vision in the eyes but even the sensation of the brightness of colours undergoes a change and becomes just the opposite. In this way, green colour appears the brightest in pitch-dark and yellow colour appears the least bright. On the contrary, yellow colours appears the brightest in a dazzling light and the green appears the least bright. Since Perkinje was the first person to discover this change in the sensation of colour brightness and in cones and rod vision, it is called Purkinje phenomena.

Q. 52. What are the various theories of audition ?

(Kolhapur 1965)

In explaining the actions connected with audition, different psychologists have presented different theories. Materially, there are three kinds of these theories—place theory, frequency theory and volley theory. All three kinds of theories will be explained here.

1. Place Theories—Helmholtz was the first to present the place theories about audition. He has explained the actions of audition on the basis of the construction and work of basilar membrane. Basilar membrane is a membrane which, by separating tympanic canal from the chochlear canal, forms a boundary between them. Just as the wires in a piano have different lengths and a specific tune is heard from each of them, in the same way the length of fibres goes on increasing in the basilar membrane in advancing from the base towards the apex so much so that the length of apex fibres is threefold of the base fibres. On account of this structural difference, all the fibres of the basilar membrane are not equally impressed by all kinds of repetitive sound waves : specific fibres are impressed by specific repetitive waves and consequently produce a specific kind of pitch. Because of a similarity in the structure of piano and the basilar membrane, some scholars also call the place theory of auditery sensation as piano theory. According to this theory, the sharpness of a sound depends on the portion of the basilar membrane stimulated by it. The larger is the portion of the basilar membrane stimulated by a sound, the quicker will be the sound sensation from it. In the same way, the more a sound stimulates some specific portion of the basilar membrane, the more will be its pitch.

The place theory about the auditary sensations has been proved to be true through various experiments. It is known through

certain investigations that the deafness of high pitch is due to some defect in the ground sphere of the basilar membrane, and the deafness of low pitch is due to some defect in the apex of the basilar membrane. I is thus clear that different pitches are connected to different portions of the basilar membrane. It has been seen, in the same way, that by stimulating the ear of some animal by high repetitive soud waves, the ground sphere of its basilar membrane is hurt.

Even then, it cannot be concluded from the above experiments that there is a complete and definite relation between the repetition of sound waves and the place of the basilar membrane. As a natter of fact, some motion or the other is seen in all the fibres of the basilar membrane on presentation of one some wave or the other. In other words, although all the fibres do not respond to the sound waves in one and the same manner, yet a repetitive sound wave, instead of stimulating some specific part of the basilar membrane, spreads all sound. It is clear that a pitch of a specific repetitive sound depends on those specific fibres which are stimulated by it in the highest degree even though its influence, instead of being limited by them alone, spreads to all the other fibres. Forbes and Gregg, in 1915, ascertained through their experiments that the decision about the pitch of some sound wave depends on those fibres which are impressed by it and send the greatest number of nervous impulses to the brain. In this way, along with an increase in the sharpness of the stimulus, the repetition of reaction also goes on increasing. It has been found out from some other experimental studies that the place theory about the auditory sensations is true to a great extent. When the outer ear is stimulated by some sound wave, there is an electric reaction. This reaction was diagrammatized with the help of electrode. This diagrm showed that this electric reaction was produced by increased repetitive sound waves in the base sphere and by decreased repetitive waves in the apex It is thus proved that there is surely some connection between the repetitive sound waves and the different places in the basilar membrane.

2. *Frequency Theory*—Rutherford was the first to present in 1886 the frequency theory about the auditory sensations but in 1918, Wrightson explained it in details and presented it in a scientific way. According to frequency theory, sharpness of the sound and the pitch were explained in a method different from that in the place theory. Against the place theory, the advocates of the fre-

quency theory are of the opinion that there is no specific relation between the sharpness of the sound and different places in the basilar membrane, because every sound wave *impresses the whole basilar membrane and not any specific part of it.* When the basilar membrane is vibrated by a sound wave, an action in the fibres of the basilar membrane is produced. This action creates nervous impulse and pitch depends on its frequency. The more the frequency of a sound, the more is its pitch ; and in the same way, the less the nervous impulse created by a sound, the less is its pitch. There is a close relation between the frequency of nervous impulse and the number of circles of a sound wave. The greater is the number of circles of a sound wave, the greater will be the nervous impulse produced on the basilar membrane. The less is the number of circles of a sound wave, the less will be the nervous impulse produced on the basilar membrane. The greater is the number of fibres of the basilar membrane impressed by a sound wave, the greater will be sensation of the sharpness of that sound wave In the same way, if a sound wave stimulates a small number of fibres, the sharpness of sensation in that sound wave will be very little. According to frequency theory, the outer part of the ear workes like telephone exchange radio Broad casting Centre. The outer part of the ear sends to the brain, through auditory nerve, a nervous impulse of the same frequency as the number of circles of a wave which impresses it. Thus, according to this theory, auditary *sensation depends on the brain action and not on* the place of the basilar membrane.

According to frequency theory, every fibre in the basilar membrane is impressed by every circle of the sound wave and sends the nervous impulse to the brain. Now, 'if this ordinary fact, that we can hear through our ear the sound waves of 20,000 circles in one second, is borne in mind, the number of nervous impulses *going from the ear to the brain should also be 20,000* per second. It it is so, the refractory period must be ·05 per second ; where as it has been proved through experiments that this period should be at least 1 M. per second which means that any single fibre of the basilar membrane can send to the brain 1000 nervous impulses at the most in one second It is thus clear that frequency theory is not proved through facts

3. Volley theory Waver and Bray presented the volley theory after amending the frequency theory. It has been accepted in this theory that the fibres of the basilar membrane do not react in pro-

portion to the number of the sound circles, specially when the frequency of sound circles is too much increased. The fibres of the basilar membrane, on being stimulated by an increased sound circles, are impressed by a third or fourth wave and not by every wave. On the other hand, if the frequency of round circles is decreased, sound impulses in them are surely produced. When the sound circles come to a definite number, all the fibres of the basilar membrane are active together at one and the same time, but the sound circles, increased beyond the limit, act on being divided in groups

For example, all the fibres, after they are impressed by sound circles of 800 per second, are active together at the same time. When the number of sound circles is more than this, fibre groups are active. This theory has taken the help of the volley frequency in explaining sound or pitch. According to this theory, auditory actions depend, not on the frequency of nervous impulses through fibres, but on the volley frequency. When a great sound is produced, there are many spurts in the nervous impulse in the ear, in every one of which there is a sensation of a sharp sound because of the existence of an increased nervous impulse.

All the above three theories about auditory sensations have their own special importance The place theory explains a sharp auditory sensation successfully Volley theory is the refined form of frequency theory and explains the auditory sensation of the sound waves of an increased frequency None of these theories is fully satisfactory Some psychologists have therefore presented some other theories No such theory in this direction could yet be presented as could be regarded fully satisfactory for lack of sufficient study and investigation in this field. Among modern theories, psychological theory of a psychologist, named Watt, about the auditory sensations is worth mentioning In this theory, while keeping psychological point in view, physiological and physical facts have not been neglected It is needless to say that in a satisfactory theory about the auditory sensations, psychological aspects along with physical, and physiological aspects are very necessary to be kept in mind

Q 53 Define aesthesiometric index Describe the experiment performed by you to determine aesthesiometric index

Aesthesiometric Index

Psychologists have made experiments to [illegible] tance which should be there between [illegible] order that the subject may feel both the points [illegible]

is applied for this test. The least distance between two points of tangency, as discovered through this instrument, is called Aesthesiometric Index. Weber has called it Difference limex. It has been found out through experiments that this difference is different in different parts of the threshold body. According to Volkman, aesthesiometric index depends on the movability of a particular part of body. It was discovered through Weber's experiments that, where as there is a perception of two points of tangency on the tip of the tongue only from a distance of one millimeter : for a perception of two points on the back, a distance of 40 to 60 millimetres between them is sometimes required. Goldschider and Bonfray, through their experiments, found individual difference in aesthesiometric index. One individual gets a perception of two points in a short distance on our and the same part of the body; whereas another individual needs a greater distance for it. Even then, the psychologists, through various experiments, have reached a common result which clearly shows the aesthesiometric index of different parts of the body. It has also been seen that vertical aesthesiometric index is different from the horizontal aesthesiometric index. Then again, if a part of the body is touched at two points at the same time or is stimulated in turns, aesthesiometric index is different in both the situations. It is generally greater in the second condition than in the first condition. The habits of the subject also affect aesthesiometric index. Habits help to decrease it some what but this decrease is possible only to some limited extent after which no further decrease is possible, however much he may habituate. Besides this, the aesthesiometric index gets decreased also in other parts, similar to the part of the body, aesthesiometric index of which gets decreased by habituation. Physical conditions also have their effect on aesthesiometric index. It gets increased in conditions of being drunk or tired. In the same way, it gets increased in case of some physical injury, pain, disease or a low temperature. It decreases in hot atmosphere. The following list will indicate aesthesiometric index of different parts of the body.

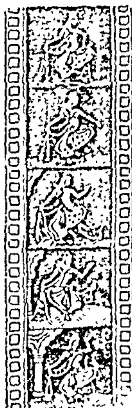
Physical part	Aesthesiometric index
Tip of the tongue	1 millimetre
Tip of the finger	2 M. M.
Outer part of the lip	5 M. M.
Nose	7 M. M.
Inner part of the lip	20 M. M.

Back of the palm	32 M. M.
Foot	40 M. M.
Arm and thigh	68 M. M.

Psychologists differ in their opinion about the basis of aesthesiometric index As has been said before, Lotze has presented the theory of Local Sign. It has been accepted by most of the psychologists but it is not fully adequate

Q 54. Write short-note on Phi-Perception *(Poona 1965)*

You must have seen cinema. Have you attentively seen a cinema reel too ? If so, you must have seen in it almost a similar picture being shown regularly in many photgraphs, with of course a minor differencе in each. Look at this reel, given on the right A woman is shown dancing in it There is a slight difference in her body poses in these photographs Now, when this same reel is shown swiftly on the screen, you see the woman dancing Sometimes, when the reel is cut short or is not fitted on the projector properly, it appears on the screen as if there are separate photographs in the reel In this way, when the film-pictures, fitted in a particular position, are shown rapidly on the screen, you have an illusion of different motions in cinema This illusion of motion is called Phi-Phenomena On the occasion of Janamashtmi, at certain places, a wheel is shown rotating in the hand of a huge image of Lord Krishna Here also there, is an illusion of motion of this kind in it. A great use of this illusion with the help of electricity is made in advertisements. To create this kind of illusion light, form, swiftness and temporary gap etc are very important Different kinds of motions are shown through them In the world of cinema, the method of creating illusion of the kind is much used



11

Reaction Time

Q 55. What is the meaning of reaction time? Describe an [exper]iment for measuring reaction time. *(Gorakhpur 1962)*

Or

Write short note on Reaction Time. *(Agra 1966)*

Or

What is reaction time? Bring out the difference between [si]mple, disjunctive and judgement reaction time? *(Poona 1965)*

[W]hat is Reaction Time?

After a stimulus present itself before us, some action from our side follows and this after action is called reaction. The time taken by a reaction to follow after, the presentation of stimulus is called the reaction-time. Practical fitness of a person depends on the speed of his reaction to a great extent. It therefore becomes important to know about the speed of reaction of a person in special circumstances as compared to that of other persons. At the same time, it shall also be important to know how far he can increase the speed of his reaction and his practical fitness through habitation and his interest in the work.

Importance of the study of reaction-time---The aptitudes of the people in vocational selection have to be ascertained. Experiments of reaction-time are very helpful in ascertaining these aptitudes. For example, in selection of a telephone operator, it is necessary to find out the speed of his reaction and the number of mistakes he commits in it. In this way, in the selection of expert motor drivers and other machine operators, a test about their speed of reaction and their practical fitness is necessary. It has been seen that the taxi drivers, whose speed of reaction is very little, commit accidents more frequently. On the other hand, persons, whose speed of action is too high, also make more accidents. The selection of such drivers, whose speed of reaction is neither too high nor too slow, will, therefore, be advisable. Various other practical advantages have been derived from the study of reaction-time. A crime has sometimes been successfully traced through experiments of word-association reaction. In one experiment various words connected with the crime, were included in the list of words placed

before the accused. Now, this list was read before the accused and so was asked to speak quickly an associated word for every word given in the list. It is a matter of common experience here that when we are placed in such circumstances where our emotions arise easily, we, either hesitate to answer a question or give a foolish and irrelevent answer. In the above experiment, the person accused also did the same ; either he reacted through very long words against the words related to the crime or atleast his reaction against these words was very different from his reaction against other words The chief reason behind this was that the meaning of the words connected with the crime was different for the accused from that for an ordinary person.

Jung, Kent, Rosnauf and many other psychologists made use of this experiment of reaction-time to discover the various complexes These complexes are unconscious and also work in one unconscious condition The person, in whom complex arise against some object or person, gives expression to extra-ordinary reaction, when the name of that object or person is spoken before the person having complexes, and in this way complexes are recognized

Kinds of Reaction-Time

In the study of reaction time, various psychologist have thrown light on its kinds, There are two kinds of reactions in a material form simple and complex, which are explained below.

1. Simple reaction-time—Among the simple experiments of reaction time, the subject has to react upon a sign made by the experimenter by pressing a telegraph key It has been seen in these experiments that the speed of reaction, in different persons and in connection with different sense organs of one and the same person, is different. How much time a reaction upon stimulus of a specific kind takes is shown in the list given below —

Kind of stimulus	Reaction time (in seconds)
1. Visual	0 150 to 0 225
2 Auditory	0 120 to 0 185
3. Tactual	0 115 to 0 190
4. Olfactory	0 200 to 0 800
5 Gustatory	0 305 to 1 080
6. Pain	0 400 to 1 000
7. Cold	0 150
8. Warm	0 180

It can be known from the above list that the time of reaction

to the stimuli of pain is the longest, because the distance between the stimulus and a feeling of pain is great enough. In the same way, in different parts of the tongue, a difference is seen in the time of reaction to different kinds of tastes. It has been found out through experiments that the time of reaction to a taste stimulus in case of something bitter is the longest, while in case of something salty is the shortest. In the same way, a difference in the reaction time is seen in the different parts of the body as well as in the different parts of the skin of the same part of the body. It has been found out through experiments that the reaction of tactual stimulus in one hand is very quick in comparison to the circumstances in which tactual stimulus is given to the other hand. In the same way, reaction time of the tactual stimulus is greater in the forehead than in the hand. Even in visual sensations, a difference in reaction time is seen according to the effect of the light waves on different parts of the eye. It has been found out through experiment that the greater is the distance of a certain part of the eye from the central point of the eye lens, the greater will be the time of its reaction to light. In comparison to monocular stimulus, the reaction time in reaction to the binocular stimulus is less. In many experiments, a sign is given for preparation before reaction. By increasing the interval between this sign for preparation and a sign of reaction, a change in reaction time is seen. If that interval is very short, the reaction time is longer; and if the interval is enough for the preparation, the reaction time is shorter. In the same way, if the interval is lasting, the subject receives a lasting attitude to it and the reaction time is consequently short. But if a change continues coming in the interval, the reaction time also goes on increasing.

It has been seen in reaction-time experiment that the contribution of distraction in reaction time is also important. This contribution is against an ordinary hope, which means that as a result of distraction, the reaction time decreases in place of increasing, because, on presentation of an obstacle, the subject makes a great attempt to overcome it. It has often been seen that the people who are habituated more or less, to work in a noise, their reaction time increases in absolute absence of noise. In the same way, along with an increase in the force of the stimulus, a decrease in reaction time has been seen. It has also been found out through many experiments that, if the reaction time of some person is decreased about some special stimulus, it can generally be hoped that

quick reactions will follow it even about the stimuli of other organs. Ludvig Lange has classified simple reaction time into the following three parts on the ground of the direction of subject's attention.

1. Sensory Reaction Time.
2. Muscular or Motor Reaction Time.
3. Natural Reaction Time.

Many important things have been discovered about these three kinds of reaction times through various experiments. It has been seen that the functional reaction time is decreased as compared to sensational reaction time Sensational reaction is complete, whereas a nervous reaction is incomplete Besides Lange, Titchener also has made experiments about reaction times of different kinds. Besides Titchener, Cattell, Baldvin and Angell also have made experiments in this connection

2. *Complex Reaction time*—Complex reaction time has been *divided into two groups as explained below*—

(*a*) *Choice Reaction Time*—Donders has called it B reaction time In the study of choice reaction time, two or more stimuli are presented before the subject and an instruction, to react to those stimuli in different ways, is given. For example, red and blue sky was shown to a subject and he was instructed to make the reaction of the red with a finger of his right hand and of the blue with a finger of his left hand The importance of choice in these experiments of choice reaction time has been very great.

(*b*) *Discrimination Reaction Time*—In a test of discrimination reaction time, the subject has to react to any one of the many presented stimuli. For example, he is asked to react to any one kind of light from among the many kinds of light stimuli presented before him In this, the subject has to discriminate. It has been seen through experiments that the discrimination reaction time is less than the choice reaction time A reduction, in both the kinds of complex *reaction times through habituation, has been seen*. Markel has made many important experiments in this direction. It has been found out from the experiments made by Henmon and Lemmon that the reaction time changes with the equality of stimuli. Dondres has called the discrimination reaction time by the name of C *Reaction Time*

Factors Affecting Reaction Time

The factors which affect reaction time are made distinct from the above explanation of its different kinds The main factors of this kind are given below—

1. *Characteristics of Stimulus*—As has been said before, sharpness, shape and extention of the stimulus have an important effect on the reaction time. It has been found out from Berger's experiments that when the sharpness of a stimulus is reduced, the reaction time is greater than the reaction time when the sharpness is ordinary. Froberg has also approved it from his experiments, although, no proportionate relation between the sharpness of the stimulus and a reduction in the reaction time was marked. As has been said before, a difference among the reaction times of the stimuli of different sense organs is seen.

2. *Group of Stimuli*—It has been found out from the experiments made by Poffen Berger and other psychologists that the reaction time to a group of different stimuli is less than the reaction time to any one stimulus.

3. *Fore Period*—Fore period means the time between a sign of attention and the stimulus. As has been said before, fore period has an important effect on reaction time. If the fore period is long, the reaction time is also long ; and if the fore period is short, the reaction time is also short. But if the fore period is shorter than even one second, the reaction time increases. According to Cattell, an interval of one second is enough for reaction time. Others have maintained that this time should be from two to four seconds. Then again, as has been proved from experiments made in Yale university, if the mode of reaction differs, it will also bring about some change in the reaction time.

4. *Incentive*—It has been found out through experiments that there is an important effect of praise and other incentives or of their absence on the reaction time. The reaction time of the subject, on his being encouraged, decreases ; where as the important reaction time of the subject increases if he is punished.

5. *Conditions of Subject*—Besides the above factors, many other conditions relating to the subject also throw light on his reaction time. Some of the main conditions are given below.

(*a*) *Age*—Reaction time of the children and old people is longer than that of adults, because in the former, their power of controlling attention and their readiness for reaction is less.

(*b*) *Physical Conditions*—The physical conditions of the subject such as temperature, tiresomeness, use of intoxicants etc. have an important effect on his reaction time. The effect of bodily temperature is very little and a moderate use of intoxicants have nos pecial effect but their use in excess has a clear effect. Reaction

time gets increased by drinking whereas it gets decreased by taking coffee or tea. *Some mental abnormalities increase and others* decrease the reaction time. Tiresomeness increases the reaction time.

(c) *Practice*—Reaction time in an expert subject is less than that in a new subject. On the basis of experiments, Cattell concluded that the effect of practice on reaction time is limited only to some experiments. It has been found out from the experiments of Cassel, Delanwak and Buddro that a diversion of attention increases the reaction time but the reaction time decreases by keeping attentive.

(d) *Attitude*—As has already been said, a favourable attitude reduces the reaction time, and an unfavourable attitude increases it.

(e) *Mental Set*—If the mental set is favourable, the reaction time is less; but if the mental set is adverse, the reaction time is more.

(f) *Attention*—As has been said before, attention and diversion of attention, both affect the reaction time. When the subject is attentive, his reaction time is less, but when he is inattentive the reaction time is sometimes more and sometimes less.

Measurement of Reaction Time

Kymograph Drum is used for measuring reaction time. Hipcronoscope has already been alluded to. Besides these, Berniercronoscope is also a good instrument for measuring reaction time. It has two pendulums. On the presentation of the stimulus, the bigger pendulum begins to swing and the smaller pendulum swings on reaction. The number of swings, which bring both the pendulums parallel to each other, is multiplied by 0.02 and the reaction time is found out in seconds.

12

Feeling and Emotion

Q. 56. Describe the nature of emotion and consider how far it can be identified with visceral sensation. *(Poona 1960)*

Ans. The word 'Emotion' is a derivative of the Latin word 'Emovere' which means 'to shudder'. Thus emotion is that state of the individual which deprives him of his equilibrium. In fear his teeth are clenched together, his body shudders and signs of perspiration can be seen upon his forehead. Emotions shake a man violently. Even when the object of his anger is no longer present, the person's arms twitch uncontrolably Emotions stimulate the energies of the creature and assist him in dealing with emergencies. In an emotional condition he performs actions which is incapable of performing in a normal state. But sometimes, through comparatively infrequently, a person is absolutely stupefied and fails to perform even the ordinary activities. These mutually contradictory results bear testimony to the fact that it is difficult to define emotion. Though psychologists have not differentiated between motive and emotion, everyday experience shows that there is some difference. Similarly, some psychologists do not find any difference in physical activities and emotion. But experiments reveal this difference which is by no means negligible.

P. T. Young has defined emotion thus: "Emotion is acute disturbance of the individual as a whole, psychological in origin, involving behaviour, conscious experience and visceral functioning." In Woodworth's opinion an emotion is a disturbed state of the body.

It is a disturbed glandular and muscular activity. Woodworth rightly says that "each emotion is a feeling, and each is at the same time a motor set." In this way emotion is that state of the individual in which the body is externally as well as internally upset. This can be clarified by an example of anger.

The emotion of anger is the painful aspect of the pugnacious instinct. Anger in the creature is aroused by any interference in the execution of an instinct generated activity, or by the failure of such activity. Therefore anger is directed upon the interfering

object or creature, though not always because sometimes anger is directed to oneself. For example, when angry, clenching of the eye brows, vociferating, kicking, attacking, trembling—these and other physical activities, or rather disturbances are apparent. The activities in an emotional condition of anger are the opposite of the activities of a person who is struck into fear. In anger a person becomes aggressive

For the importance of physiological factors see the question and answer No. 58.

Q 57. Clearly distinguish between Emotion and Feeling

(Bombay 1959, 1958; Gujrat 1960)

Ans. Both emotion and feeling are closely related to one another. They both depend on the brain stem in the nervous system. Pleasure, pain, fear, anger, love and gaiety etc., involve feelings as well as emotions Consequently many of the emotions are linked with feelings Feelings can be pleasant and can be painful too. Similarly, emotions may be caused either by happiness or by sorrow

In spite of such a close relation between feeling and emotion they are not identical and this difference should not be lost sight of. Feeling is the reaction of pleasure or pain originated by the sense organs, which results from sensation. For example, the observation of a rainbow in the sky results in a feeling of pleasure. When a thorn pricks the foot, a feeling of pain is generated. Thus, feeling is sensory and simple, whereas on the other hand, emotions are more complex They can be around not only by the existing circumstances but also by a recollection of these circumstances Players are excited by the imagination of decision of the failure in the game. We are filled with hatred when we are reminded of disgusting circumstances Another difference between emotion and feeling is that while feeling is aroused by sensory reactions emotion is activated by thoughts and imagination, not by sensations. It follows that there is a difference between emotion and feeling from the mental view point The difference between their mental qualities is the result of the contributory circumstances from which they originate Emotion is evolved at a more complex level and new elements are introduced in it The pleasure which we receive by listening to a good discourse or by reading a good book is not due to the words as such but due to the thoughts expressed by these words. The pleasure which arises out of listening to an oration by a famous leader is due not to the voice of the leader, but rather

to his opinion. These are examples of emotion.

Another substantial difference between emotion and feeling is that the former is more comprehensive than the latter. Feeling is a part of emotion. Emotion includes feeling and it is therefore something more than a feeling. This closeness of the relation of the two often causes people to forget the difference between them. In emotion some glands inside the body excrete some specific types of juices. But there is no excretion in the case of feeling. In feeling there is more neural excitement than in emotion. At a certain stage, even a tendency to become active is perceived.

Emotion is more vigorous than feeling and it upsets the whole body. The individual is divested of his stability and his control over the situation. Consequently, the necessary reaction is inpeded in its execution and behaviour is distributed. The derangement is present in feeling too, but not as much as in emotion. In reality, slightly disturbed state indicates feeling and a greater disturbance points to emotion. In an emotional state the behaviour of a person is more excited, vigorous and disturbed than in feeling. Feeling is never as full of excitement as emotion is. In the grip of emotion a man sometimes transcends every type of limit, reason being completely paralysed. Feeling never attains such a frenzied state. Pleasure is never as effective as anger is. (Also see next question's answer).

Q. 58. Describe major bodily changes during emotion.

(Delhi 1967)

Emotion results in bodily changes which can be classified as external bodily changes and internal bodily changes.

External Physical Changes

Generally, emotion is identified with bodily changes. An emotion is guessed on the basis of external physical changes. If a person grinds his teeth we say that he is angry. When a person trembles it is remarked that he is nervous. In love our face lights up, in grief our eyes are filled with tears and in surprise our eyes dilate In this way, a difference in the expression of the eyes, nose, mouth, forehead etc., is discernible in emotion. A person's voice is altered and he adopts a fresh posture. These are the external changes in the manifestation of emotion. These will now be described in detail.

1. Facial Expression When under the influence of emotion, the facial expression of the person is the first to be altered. It is easiest to read the emotion of love or hate from the face. No amount of effort can successfully disguise the facial contortions

in strong emotion, from an experienced observer. In an emotional state the muscles of the face expand or contract. In pleasant emotion, it is said, that the face lights up with delight, this lighting up refers to the muscular expansion. Similarly, it is said that the face hangs down. The reference is to the contraction of the muscles. Prevalent saying such as blushing with shame or averting the eyes, expansion of the eyes in fear, elevation of the eye brows in anger are used to describe the changes in facial expressions in emotion. Many psychologists have experimented in order to determine the meaning of a variety of facial expressions. Some experiments seem to indicate that the facial expressions by themselves are insufficient to enable a distinction to be made between the emotions, but the data collected from these studies is insufficient.

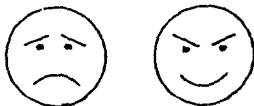
(1) It is difficult to get the normal emotion in the artificially created situation in the laboratory.

(2) In different cultures the mode of expression of the various emotions is not uniform.

(3) Even if the normal emotion is produced in the laboratory it is necessary to photograph it at high speeds.

4. In the recognition of emotions, experience and instructions are indispensable.

In reality, it cannot be said with any degree of certainty that it is not possible to recognise emotion from the facial expression. Even after the effects and impressions of the culture, there is a degree of similarity in the facial expression of emotions of the members of every society. It is easy to recognise the conflicting expressions of pleasure and pain in Leonardo da Vinci's sketches given below.



2 *Vocal Expression*—Emotions can be expressed through the medium of voice and through this medium similar emotions can also be aroused in others. In expression of emotions the voice is influenced *i e*, the pitch and loudness of the voice changes. Th

voice of an angry person is hoarse and loud whereas a loving person's voice is rythmical and sweet. Some of the stronger emotions can be thus distinguished by hearing the voice. Sometimes even language can successfully excite emotions.

3. *Postural Expression*—In an emotional condition, the posture is affected too. These changes are not similar in all societies and in all the members of society. When frightened a person is seen either running or standing still. In love, embracing, kissing, etc., may be observed but these show substantial changes in different societies due to the effect of culture. When angry some people use foul language, others pace about in a frenzy and still others attack. Rubbing hands, clenching fists, standing erect, sitting with a bowed head, hiding, flinging the arms about etc., all indicate emotion but identification of emotion depends upon the person and the society to which he belongs and is possible only after adequate research.

Internal Physical Changes

Beside the external changes mentioned above, there are some internal physiological changes too, is an emotional state. When surprised our breathing almost stops. Our heart beats faster when we are angry. But these internal changes can be known only when they are measured by instruments. Some major changes are detailed below :

1. *Change in heart beat*—Generally, the heart beats faster or slower if the individual is disturbed. This fact is utilised by literary people, as they mention this fluctuation of the heart beat to show the presence of emotion. The face is flushed or blood shot in anger, because the alternate contraction and expansion of the blood vessels sends an excess of blood to that part of the body. This abnormal activity is the result of the altered heart beat. The blood pressure of all those who were present rose when Scott, during his experiments, exhibited some sexually exciting photographs.

2. *Blood pressure changes*—We saw above how the heart beat changes and affects the blood pressure, this change, being very prominent, is very noticeable and is generally considered to be a good indicator of emotion. It is measured with a Plethysmograph. It can be used as a lie detector though its validity is restricted to the inexperienced deceiver because only such a person will be disturbed or upset at the prospect. Contradicting all that we have been asserting all along are some experimental results which prove that this change is not inevitable. Examining some

soldiers injured in war it was noticed that their blood pressure was not noticeably altered, in spite of the emotional experience of the war, while the visiting relatives were more severally affected, as was proved by their blood pressure.

3. *Change in the Blood Chemistry*—This is not all, because in an emotional state some changes in the chemical condition of the blood also take place. Another reaction to the emotion is the excretion of adrenaline from the adrenal gland, which puts more sugar in the blood and gives person a reserve of energy to rely on and face the situation The effect of Adrenaline is felt in order quarters too There is more sugar in the urine, blood pressure and heart beat increase and some capillaries in the skin start contracting

4. *Change in the Rate of Respiration*—It is a matter of common experience that when excited, one's breath comes in short, quick gasps. When a person is feeling sorry or depressed he breaths slowly. These changes are measured with a pneumograph. Commonly, emotion causes changes in the rate of respiration.

5. *Change in Galvanic Skin Response*—A psychogalvanometer is an instrument used for measuring the resistance of the skin to an electric current A skin dampened by perspiration offers more resistance than usual. Previously, this state was supposed to be *the peculiarity of emotion, but it has now been established that* the same state will be the outcome of any physical or mental exercise But still the response of the skin is present in emotion and is a definition of the emotional state.

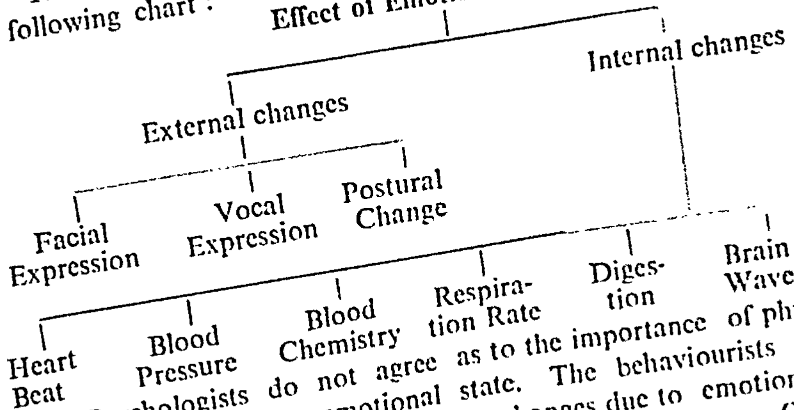
6 *Metabolic Changes*—Another important factor in the internal changes is the effect upon the process of digestion. But it has not been finally proved whether the change differs in different emotions or not. Burnswick's experiments on human beings showed that in fear, sorrow etc., the processes of digestion are interrupted or stopped but in surprise the process was apparently accelerated and happiness left the digestion indifferent.

7 *Changes in Brain Waves* The frequency of brain wave is affected in emotion This change can be measured by instruments.

These are major internal and external changes but they do not include everyone *There are some other psychological changes* which are apparent in emotion e g, when a person is extremely frightened he may excrete urine etc This is a tendency present in every animal and bird This comprehensive study of internal and external psychological changes must have made it very clear

...at in emotion there are changes, though it is not possible to determine with accuracy the connection of a certain emotion with a certain change.

These changes due to emotion will be clarified further from the following chart :



Psychologists do not agree as to the importance of physiological changes in an emotional state. The behaviourists place much emphasis on the physiological changes due to emotion and do not give any credence whatsoever to the mental responses. On the other hand, some psychologists lay an equal emphasis upon the mental changes. Looking at it realistically the physiological changes cannot be assumed to be everything, but then neither can they be neglected and considered insignificant. Similarly, the mental aspect of emotion can neither be neglected nor relied upon exclusively. It is necessary to understand both the aspects to understand emotion completely. As experiments are still being conducted in both these aspects, it is necessary to keep in view the psychological changes as well as the functions of the different parts of the brain while making a comprehensive study of emotions. A fully satisfactory theory of emotions can be evolved in the future only with a balanced viewpoint.

Q. 59. Discuss the Jame Lange theory of emotions.

Ans. In 1884, the famous American psychologist William James, published his theory of emotions. In 1885, a Danish psychologist Lange, independently presented his theory of emotions. Due to many points of similarity between the two theories, this theory became famous as the James-Lange theory.

The James-Lange theory is the very antithesis of the popular belief about emotions. The theory states that physiological changes take place upon perceiving the circumstances and the changes makes an emotion felt.

Thus according to this theory, emotion is a pattern of organic changes. The external stimulus excites one or more sensory organs. The excitement is sensed and conveyed by the sensory nerve impulses to the cerebral cortex whence there is a knowledge of the specific stimulation. Next, the nervous impulse goes to the muscles and the viscera which are excited. The excitement is then conveyed to the brain via the sensory nerve impulses. And from this results arousal of emotion. James in his book *Psychology* has presented his theory saying that his theory is that physical changes immediately succeed the perception of the stimulating elements, and emotion is the experience or feeling of these changes as they take place. General opinion says that when we lose our wealth, we are grieved and we cry, when we see a bear, we are frightened and we run, when we are humiliated, by our rival, we feel angry and we attack. It is more logical to say that we feel aggrieved because we cry, we feel angry because we attack, we are frightened because we tremble Similarly, Lange has also maintained that physical actions cause emotion He writes that the vaso motor system is responsible for our pleasures and discomforts, joys and sorrows, in fact, the entire emotional side of our mental life.

The following are the more important arguments in favour of the theory :

Arguments for James Lange Theory

1 *Perception causes bodily changes without arousing the emotion*—According to James, if we see a mobile black image in the jungle our heart stops beating and we start trembling before any clear idea of danger is conceived Apparently, in this case the perception and bodily changes precede the emotion

2 *An emotion cannot be imagined in the absence of physical expression*—According to James if we imagine an emotion and then try to remove the signs of its physical experiences from our consciousness we do not find any such thing which may constitute an emotion Whatever is left is only an immutable state of feelingless intellectual perception

To experience an emotion it is necessary to adopt a suitable bodily posture Witoout it, the emotion cannot be felt.

3. *The suppression of physical expression results in the suppression of related emotion*—If the emotion is not permitted to express itself, it is destroyed. One tries to amuse a person who is crying on account of sorrow because it is generally believed that

if he ceases weeping, his sorrow will be reduced or that he will be happy if he laughs. In practice it is seen, that this is exactly what happens generally.

4. *The artificial creation of physical expression creates the related emotion*--Presenting the examples of actors, James said that, while acting, they experienced the emotions the physical expressions of which they were enacting. When alcohol and other stimulating drugs are consumed, the manifestation of the various physical conditions results in the experiencing of various emotions.

5. *Some bodily abnormalities cause emotions*—Giving an example of this, James says that the troubles of the liver cause a loss of appetite and touchyness while mental diseases cause fear and despair. In James' opinion, objectless emotions are the result of bodily infirmity.

In this way, theory does not distinguish between emotion and physical sensation. Ward says that in this theory emotions are a group of physical sensations and these sensations are emotions. They are not only complementary but inseparable too.

This theory has been bitterly criticised. The following are the main points of criticism.

Criticism of the James-Lange Theory

1. *Emotional reactions are possible even in the absence of the physical correlates*--Sherrington operated upon many dogs and severed the connections of the extremities and the brain by operating upon the spinal cord. But this did not affect their emotions in any way. Cannon and his assistants proved a similar thing in the case of cat. Dr. Dana proved it too, by observing the case of a fourty-year old lady who exhibited and felt emotion even though she could not receive any sensations from the sympathetic nervous system.

2. *Contradictory results have been obtained from actors*--Archer found that many actors do not feel any emotion when they are acting.

3. *Visceral and internal changes and infirmities do not make emotion inevitable*--Cannon and his followers administered injections of the excretion of the Adrenal gland to common people and caused many internal and visceral changes. But nobody felt any emotion due to these changes. Vernon, Cantril and Hunt, also achieved similar results from their experiments.

Even alcoholic drinks failed to arouse any emotion.

4. *The absence of the sex organs did not undermine a person's*

sexual emotions—Maccurdy wrote that a person unaware of his sex organs, still expressed a sexual interest in the hospital nurses.

5. *The emotions cannot be differentiated on the basis of physiological changes*—If emotion is the result of physiological changes then the creation of one emotion by various changes or the presence of the same changes in different emotions cannot be explained, though this is noticed in daily life.

6. *Objectless emotions are not, in reality, objectless*—Titchener pointed out that the objectless emotions are unmotivated remnants of motivated emotions which result from old emotional tendencies.

7. *In different people, one emotion produces varied physical changes* while the same changes may be observed as a result of different emotions Therefore, emotion and physical changes cannot be believed to be inseparable

8 *James has not distinguished between emotion—producing and unproductive physical changes*—Stout says that undoubtedly, every bodily change is not emotion Hunger and stomach ache are not emotional experiences

9. *If emotions result from a mere perception of the objects, then why is it that similar stimulants do not arouse similar reactions?* Ward says, "Let us suppose that at first James faced with a caged bear and then with a free bear In the first case he feeds it ground-nuts while in the latter he runs away from it " Obviously, emotions are aroused not by objects but by circumstances. Woodworth opined that emotions are aroused when some instinct excited by the circumstances is not satisfied Drever is also of the same opinion. McDougall, has also stressed the instinct-originated element in emotion

The arguments against this theory of emotions prove its unscientific nature. Later on James made some amendments in his theory and accepted that the perceptible object is influenced by the background. He went so far as to accept the presence of a feeling core between perception and the physiological changes As a result of this change, emotion was no longer considered to be the result of perception nor was physical expression predominant in emotion *Consequently the amended James Lange theory* confirmed the popular opinion. As a matter of fact the importance of this theory in psychology lies in its emphasis upon physiological changes in emotion Its elaboration upon the subject of emotions is, however, unsatisfactory

Q 60 Give the different theories of emotion *(Kanpur 1974)*

Ans For Jame Lange theory please refer to the answer to Question 59.

Cannon's Theory

Cannon's theory regarding emotions is also known as the Emergency Theory or the Hypothalamic theory. According to this view, the major part in emotion's reactions is played by the excretion of the Hypothalamus. In this view, the cerebral cortex is the centre of emotional feeling while the internal brain or Dien Cephalon, which is formed of hypothalamus, and thalamus, is the centre of emotional expression. The nervous impulses reach the thalamus through the sensory nerves. The thalamus attaches to this an emotional quality and passes it on to the cerebral cortex so that the person experiences a specific emotion. While sending it on to the cerebral cortex, thalamus deflects a part of the nervous impulse to the viscera and the skeletal muscles. This results in a change in them which can be observed.

It is undoubtedly true that Cannon's theory is more appropriate than the James-Lange theory. It has been proved that the hypothalamus does have a hand in the control of emotions. The acceptance of this theory makes it possible to understand how the emotions remain unaffected by the severance of the spinal cord or by the mild reactions of the viscera. It also explains the failure of adrenaline injections to arouse emotion. But this point of view is limited and one sided. As Lashley has shown by his experiments, every aspect of emotion cannot be explained by this theory. In reality, the other parts of nervous system have as much a hand in emotions as the hypothalamus. For example, the cerebral cortex has a greater part in the adjustibility of emotions.

Motivational Theory

In presenting the motivational theory, Leeper made emotion completely motivational and proved this fact through experiments. According to this theory, every emotion has a goal which pilots and guides the emotional action. Leeper has proved that every bodily change assists in the adjustment of the individual. Rate of respiration, heart beat, blood pressure, perspiring and visceral functioning all help the individual to adjust himself to the contingency. The excretion of the sympathetic nervous system spurs him to greater effort. Other sympathetic reactions keep the body safe.

Every day experience makes it quite obvious that emotional actions have a goal and that they help in adjustment. For example,

we run away from a snake because we are frightened and we wish to save ourselves. Thus the motivational theory is true to some extent but only in the simple condition of emotion If a person is extremely frightened he stays rooted to the ground and gets bitten by the snake. Similarly, in a state of extreme agitation, like extremely sexually excited situation, the person's adjustment to the situation becomes worse instead of getting better. In reality, the motivational theory is correct in common emotional states, but it seems to lose its value with the increase in intensity due to the fact that in such conditions the actions in emotion are not directed towards adaptation. A psychologist E. Mira disproved this theory by pointing out stages of development in fear. Mira's study indicates that in different stages the inhibition in emotion increases and he activities of the higher nerve centres are restricted.

Activation Theory

The most modern theory advanced on this subject is the Activation theory It has accepted all the important aspects of the above mentioned theories In keeping with the Jame Lange theory, it accepts the importance of physical changes and expression It agrees with Cannon's theory on the importance of the hypothalamus. It accepts the part played by the sympathetic nervous system and the assistance of emotion in adjustment which is in keeping with the motivational theory.

The Activational theory has emphasised the activities of the cortex because this theory originates from a study of brain waves It is based on research in the physiological field This theory propounds that in emotion the whole body and not any one part of it takes part Consequently it cannot be said that emotion is based on some specific part The arrangement of emotional activities can be affected only by the adjustment of the activities of the various parts of the brain Thus, an understanding of the internal activities of the brain is necessary for an understanding of emotion. Though, the activation theory of emotions is superior to all the preceding ones, it is not the final theory Some more experimentation is necessary to say anything definite about this subject

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13
Learning

Q. 61. Define learning and explain its conditioned response method.

"*Learning is a function of what is learned, how it is learned and who learns it ?*" Elaborate. *(Prana 1966)*

The following are some definitions of learning which should make it clear --

1. Learning is change in behaviour—In J. P. Guilford's opinion, "We may define the term very broadly by saying that learning is any change in behaviour, resulting from behaviour." In this definition a distinction between change in behaviour due to maturity and change in behaviour due to learning is not clear though both these activities occur simultaneously. In the words of Woodworth, "Typically at least learning consists in doing something new, provided this something new is retained by the individual and reappears in his latter activities."

2. Learning is an organisation of behaviour—According to Garrett, "learning is that activity by virtue of which we organise our response with new habits." Thus the element of organisation in learning is very much important. Guilford too, maintains that learning involves organisation of behaviour. Thus in learning to ride a cycle we have to organise the activities of turning the pedal, balancing the handle, etc. in order to be reasonably safe with the vehicle. It is another matter that a person does not learn this organisation at the outset and that he may take much longer time to learn to balance the handle than the time he may take to learn to turn the pedal. But his learning of the activity of cycling will be complete only when he accomplishes this organisation.

3. Learning is the reinforcement of a new activity—R. S. Woodworth maintained that the learning of a new act is an addition to the person's store of experiences. Clarifying the statement further, Woodworth says that reinforcement, too, is an indispensable element in the act of learning because it helps forming only successful responses and weeding out the unsuccessful ones. To quote Woodworth "An activity may be called learning in so far as it develops the individual in any way, good or bad and makes his

environment and experiences different from what it would otherwise have been."

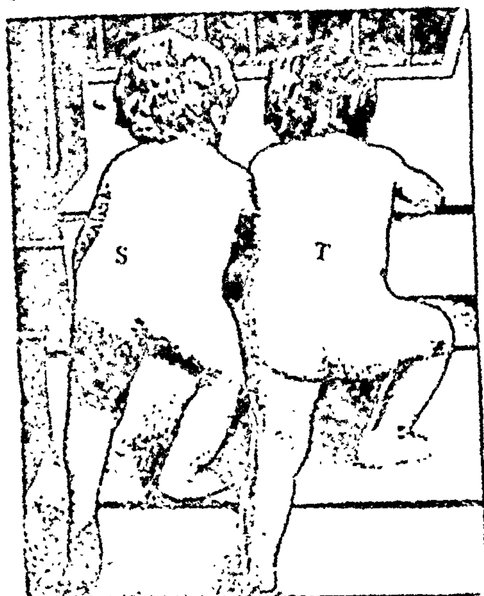
The psychologists who stress external behaviour consider learning to be a change of behaviour while those who lay emphasis on internal changes are convinced that learning is change in the perception of the individual. Combining these two views, Murphy writes, "From this point of view it would be legitimate to regard learning as a modification both of behaviour and of the way of perceiving". The following definition of learning given by Hilgard is an essence of all the foregoing definitions offered by other psychologists. "Learning is the process by which an activity originates or is changed through reacting to an encountered situation, provided that the characteristics of the change in activity cannot be explained on the basis of native response tendencies, maturity or temporary status of the organism."

LEARNING AND MATURATION

Learning changes behaviour and so does maturation. Thus *some times it becomes difficult to say definitely as to which of the* subject's activities are the result of learning and which are the consequences of maturation Automatic activity, random acts, reflexes and instincts and sudden expression of emotion can be accepted as unlearned actions and the result of maturation, but in most of the activities of human beings it is difficult to decide whether these activies result from maturation or learning In fact, these activities develop both due to learning and maturation. Take the example of learning a language It is true, of course, that a child is manifestly incapable of learning languare until he reaches a certain stage or age in maturation, but it is also equally true that he does not learn the language just because he attains that stage The language is taught to him

An experiment on co-twins indicates the extent of the changes in behaviour caused by maturation and the extent to which changes may be affected by learning. The purpose of the experiment was to measure the extent of advantage of learning in such activities as climbing the stairs *Two twins were chosen for the experiment* because due to the similarity in heredity, the speed of maturation is the same and any changes which may occur may be attributed to learning. One of the twin 'S' was not given the opportunity of climbing stairs for 53 weeks while the other twin 'T' was taught to climb the stairs from her forty sixth week On examination the

twin 'T' failed to climb at all at the age of 46 weeks and had to be aided up all the 5 stairs. In the space of four weeks she climbed all the stairs in 26 seconds.



When 'S' was placed on the stairs at the age of 53 weeks she climbed all the five stairs unaided but it took her some 45 seconds. After two weeks of practice 'S', at the age of 55 weeks, traversed the distance in 10 seconds. In this way, at this age 'S' was ahead of 'T' who, at a younger age had practised three times as much. 'S' was three weeks older than 'T'. Thus in spite of all kinds of learning, T was left behind, due to a lack of maturity.

This experiment proves that learning plays an insig- nificant part in reflex and other physiological activities peculiar to one's species. Those activities which appear in all human beings at a certain age, are due to maturity. Those activities which do not inevitably appear in every person are affected by maturation to the extent that they can be learnt with ease at the age of maturity. Some examples of this type of activities are swimming, horse riding, climbing trees etc. The learning of these activities is made more facile by motor, sensory and neural maturation.

Conditioned Response Learning :

As a general rule the higher the species of the animal, the more easily conditioning of response is achieved. Thus conditioning should be the easiest in the case of human beings. But man is a complex animal and hence the factors which distract his attention are larger in number than in the case of other animals. However, inspite of these distracting elements in conditioning of responses it certainly remains one of the most important methods of learning. especially in the case of children. In childhood many of the res

ponses of the child are conditioned to particular objects and even when the individual becomes an adult, his conditioned response continues *e.g.*, if a man behaves wrongly with us, we develop a kind of fear, abhorrence or hatred with every person resembling him.

Modern psychology does not admit the view that all learning is conditioning, but no psychologist denies that conditioned response is an important method of learning both in the case of animals as well as of human beings. A person can find hundreds of examples of conditioning of response in his daily life. In the case of the tamed animals the conditioning process is very much used to teach so many activities. The conditioning of response as it is established can also be extinguished In the establishment of the conditioning the stimuli has to be repeated while in its extinction the stimuli is not repeated] Thus in the example of Pavlov's dog, if the dog's response has been conditioned by the ringing of the bell, it will be de-conditioned if food is not served inspite of the ringing of the bell or food is served without ringing of the bell. Similar examples of de-conditioning process can be found in the case of human beings Suppose a person is used to get out for a walk to a bridge with a certain friend, he will always remember his friend when he is absent The sight of the bridge will make him recall his friend, because he always used to come with him to bridge. Thus the bridge and the presence of his friend have been linked. Now if the friend is absent and returns after a long time and the man has to go alone for a walk, he will forget his friend gradually and the sight of the bridge will no more awake the memory of him. In this example, one finds de conditioning of a certain response to a particular stimulus. Just as a response can be de-conditioned, it is also re conditioned. Conditioning, de-conditioning and re-conditioning of the response are governed by the same fundamental principles

Q. 62. Write short notes on—Trial and Error Learning

TRIAL AND ERROR

The method of trial and error is used in the following circumstances :—

(1) This method is used when the learner is completely motivated and can see the goal clearly. If the cat is not hungry she will not try to come out of the cage or leave the attempt after trying it without success for some time. The cat tries to come out of the cage simply because she is hungry and knows that there is

food outside the cage. In the absence of the food outside the cage the cat will not try to come out of it. Thus it is clear that motivation as well as the presence of the goal is necessary for awakening the response in learning through trial and error.

(2) The method of trial and error is used when perception alone or learned activities are not sufficient. If the cat could come out of the cage by merely moving in some direction, there was hardly any need of several trials and errors.

(3) The method of trial and error is used when the learner fails to find the solution of the problem. In Thorndike's experiment the cat used trial and error method simply because she did not know how to come out of the cage. In the case of human beings in such situations, if the subject knows the solution of the problem, there is hardly any question of trial and error. It is only when he fails to find out the solution, of the problem' that he proceeds blindly, tries in various directions, commits errors, eliminates them and finally arrives at the successful response.

Thus the method of trial and error is widely used both by animals as well as by human beings. In the case of human beings however, this process is somewhat different, because man has better powers of perception, understanding, intelligence and language etc. Man uses the method of trial and error, but he also takes the help of language and other instruments in the process of learning.

Q. 63. Write short note on—Learning through insight.

(Agra 1965)

INSIGHT

Insight is an important constituent in the solution of problems, and is found in the higher class of animals and human beings. It is the best method among the methods of learning.

According to the gestalt psychologists, a person can deduce the solution by insight if he perceives the situation as a whole. A German gestalist, Kohler, prepared some simple problems for experiments with dogs, hens, monkeys, and chimpanzees. In an experiment, a hungry animal was released from the house while some food was placed behind the fence adjoining the wall. Both the dog and the hen trotted around in the vicinity of the wall but as soon as they found the way out they made their exist and reached the food. This perception of the change in the meaning of the wall is insight. Before the insight the wall was an insuperable obstacle, but after

insight it was no longer an obstacle but an object necessitating circumvention. The result of insight is the understanding of few relations, the discovery of new patterns and the formation of new organisations

The most famous experiments conducted by Kohler, in relation to insight were those that were carried out on chimpanzees. Some bananas were placed outside the cage of a chimp called Sultan, who was then given two sticks so constructed that they could be fitted together. Sultan tried to pull the bananas with the sticks, an effort which he kept up for an hour, but he got tired of the attempt and gave it up for playing While playing he brought the two ends together and suddenly he got an idea which resulted in his fitting the smaller stick in the hole of the bigger one. He then used the two together to draw the banana inward. The two sticks disintegrated but he fitted them together again. He then pulled in everything within reach as if he were trying out his discovery The next day he took far less time to fit the two together. It is a peculiarity of insight that once the solution is learnt, it is not forgotten though its memory may become hazy with the passage of time.

The above experiments make it quite obvious that learning by insight has certain characteristics of its own. They are briefly as follows—

1 Insight is sudden

2. Insight alters perception.

3. Old objects appear in new patterns and organisation by virtue of insight.

4. Insight is relative to the intellectual level. The higher species of animals including human beings have more insight than the members of lower species

5. In insight understanding is more useful than dexterity of hands

6. In Woodworth's opinion, insight is sometimes hindsight and at others it is foresight. To quote him "Foresight is seeing the way to the goal before taking it or perceiving the uselessness of a certain lead without buying it and hind-sight is observing that a lead is good or bad after trying it When the whole situation is clear and above-board, there is a good chance for foresight, but when important characteristics of the situation have to be discovered

by exploration and manipulation, hindsight is the best we can expect.

7. Previous experience is of assistance in insight, though the excess of previous experience does not necessarily increase insight because organised perception too is an essential factor in learning.

8. Maturity also effects insight as evidenced by the smoother working of insight in older age than in adolescence.

9. If the pieces essential for the solution of the puzzle are present together when perceived, insight comes about earlier.

10. Some psychologists say that learning by insight is associative learning. Insight appears suddenly after the manipulation of thoughts or objects for a small though significant length of time.

11. The insight gained in particular circumstances is of assistance in other circumstances. A verbal formula is generally extracted by people learning by insight a d this formula is capable of facile application to other circumrtances.

The above mentioned characteristics of learning through insight apply both to human and animal learning. The solitary difference is the fact that a human being by virtue of his superior capacities of experiencing and understanding, observes relation between various objects quickly and sees the patterns concealed in them with alacrity. He is assisted in this by language. As a matter of fact insight occurs only when the learner perceives the related link hidden in the activity. The learning curve is altered suddenly due to insight. Insight is impossible in an extremely unfamiliar problem because familarity is very necessary for insight A student of literature will have no insight in any scientific problem because he does not know even the a b c of science. When the subject of study becomes a part of life, insight becomes easier. History can be made alive by exhibitions, Geography by travelling, and Arithmetic by shop accounts. Familiarity is also important besides the theoretical study.

One example of human learning by insight will suffice. A student of Arithmetic tries hard to solve a difficult problem of Arithmetic. He tries many methods but fails to secure a solution. He gives up and lays it aside or goes to sleep. After sometime suddenly or when he is awakened the solution suggests itself and

he notes it down in his note-book. When he is confronted with similar problems in the future, he will have no difficulty in solving them.

The insight method is superior to imitation or conditioned response because both the latter methods take more time.

Trial and error emphasizes the acquisition of motor skill but in insight mental effort is stressed upon.

While insight depends upon perception, trial and error depends upon sensory motor co-ordination.

The person keeps an eye on the goal, in trial and error and all activity is goal directed but insight is in the unconscious mind which exerts the most while the conscious activities are either very few or aimless.

Every new problem has to be tackled from the very beginning if the trial and error method is used. On the other hand, both generalisation and differentiation are present in insight, which adds to the possibilities of transfer of learning and the use of old insight in the solution of novel problems

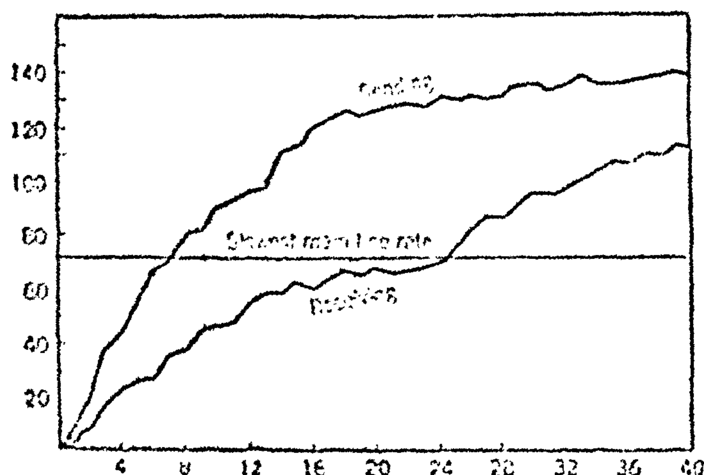
Students will be permanently helped by the use of the insight method of learning in place of the trial and error method in their study and other daily activities They will also be able to conserve their energy. Suppose that a person has to arrange furniture in a room An average person will determine the position of the table by using the trial and error method and shifting the table from place to place. An intelligent person will take up a position from where the whole room is visible, and imagine all the possible positions of the pieces of furniture in an imagined frame work of the room and then place the respective pieces accordingly But this does not mean that trial and error method is not meant for the intelligent. By no means is this so. In many novel situations progress is not possible without it An intelligent person should use both these methods according to the needs of the situation

Q. 64. Describe a typical learning curve and explain the underlying factors *(Ravishankar 1965)*

Learning curve

Learning is not always a continuous process Sometimes there is a steady progress in learning while at other times there is hardly any progress at all Sometimes one notices even retrogression in the process of learning Thus when progress of lear-

in the case of a student of telegraphy is shown on a graph paper, one finds a learning curve rather than a straight line. In the learning curve given in the figure below, the upper curve shows the speed of the words sent per minute. The rise of the curve shows the progress in sending or receiving of the words. At one end of the curve, one notices a plateau of learning.



Two facts are clear from the above figure of learning curve, initial spurt and plateau. The initial spurt can be seen in the curve of all types of learning. In the learning process there is a progress in the beginning and the speed increases with the increase of practice. In the subjects where insight is possible it increases learning very much. But in other types of learning the learner sometimes reaches a stage when the curve instead of going upwards seems to be horizontal and no progress is recorded for a certain distance. This flattened surface is called *plateau of learning*. In the figure given on the last page, one finds the receiving curve rising gradually till it arrives at the physiological limit after which a flattened surface is noticed. The curve again rises after the plateau of learning. The reason for this rise is the co-ordination of the simpler habits with the complex ones. In the figure given above there is no plateau in the sending curve.

There can be several reasons for the plateau of learning, of which the most important are following

(1) Absence of the proper motive :- The most important cause of plateau is the absence of proper and sufficient motive. In the case of factory labourers it has been observed that their speed increases after getting sufficient bonus.

(2) Insufficient co-ordination of the simpler habits with the

more complex ones—As it has been said earlier, learning requires co-ordination of the simpler habits with the complex ones. When this co-ordination is achieved progress is noticed. Hence insufficient co-ordination between simple and complex habits is one of the causes of plateau in the learning curve. This can be seen in the *habits of sending the letters and words in telegraphy*

(3) **The conflict of old habits with the new ones** :—Learning requires new habits. Hence there is conflict of the old habits with the new ones, *e* g., a man used to a particular method of learning will find it difficult to leave it and to adopt a new though more profitable method.

But when learning by a particular method reaches the physiological limit, further progress becomes difficult. In the case of the curve of time when a man reaches a point after which he cannot progress it shows his *physiological limit.* As, for example, every sportsman has a physiological limit, beyond which he cannot break his records. If one finds no progress even when a certain task is done with the right process, one should suppose the existence of physiological limit But it is very difficult to determine the right method. The daily amount of work put in by the labourer should not be taken as his physiological limit, because in the presence of new motives he shows more progress

Q 65. Explain modern theories of learning.

Theories of Learning

Many psychologists have presented some new theories about the definition of learning in modern times The names of Tolman, *Hull, Guthrie, Skinner, Wheeler and Levin* among them are more famous. These theories will be briefly explained here

Sign Gestalt Theory—Tolman has advocated this theory in explaining learning. The main specialities of this theory are given below :

(1) **Behaviourism**—Tolman is a behaviourist and is against the introspection method. Here he agrees with the ideas of Watson

(2) **Molar Theory**—Tolman's theory is molar, where as Watson's theory is molecular According to it, although group behaviour is made of individual behaviour, yet in defining behaviour, group should be emphasised and not the individual.

(3) **Goal Directed Behaviour**—This group behaviour is taken by Tolman to be goal directed. According to it, every behaviour has some aim, and the form of it is established by the means of reaching the goal, obstacles etc.

(4) **Changing Behaviour**—The group behaviour of an organism is not stable and fixed, but it is changing because it seeks to employ the least energy in behaving.

(5) **Definition of Behaviour through Intervening Variables**—Tolman has defined behaviour on the basis of intervening variables. These intervening variables are of two kinds—circumstancial and individual. Intervening variables mean the events or conditions which are presented in stimulus and response. The intervening variables can be imagined on the basis of mutual relation between stimulus and response. Tolman calls stimulus a free intervening variable, and calls response a dependent intervening variable, because response depends on the stimulus. Although the relation between stimulus and response is subjective, yet it can still be measured in objective form. Intervening variables are not only physiological and physical, but are also psychological. There is a place in them also for cognitive and purposive processes. Demand and expectations are two main intervening variables. On the basis of these, Tolman, like gestalt psychologists, is called centralist. Here his ideas are quite different from the ideas of Watson who is a behaviourist. While Watson's viewpoint is physiological, the viewpoint of Tolman is psychological. While Watson regards behaviour to be only mechanical, for Tolman, it is goal directed.

Basic principles in Sign Gestalt Theory—Osgood divides the theory of Tolman into the following four parts.

(1) **Motivational Principles**—Before the theory of Tolman was presented, most of the psychologists were of the opinion that an organism repeated only these actions which satisfy its motivations. Hull is of the opinion that organism performs some actions to remove the tension which is produced on presentation of some need. It decreases its tension. In this way, these psychologists regard reinforcement as something necessary in learning. On the other hand, according to Tolman, while reinforcement is necessary for activity, it is not needed in learning To prove his idea, Tolman made a learning experiment. In this experiment, some rats had to learn a puzzle. Experiments on three groups of rats were made. The rats of the first group were fed after they were

taken out of the puzzle-box. The rats of the second group were not fed after they were taken out of the box. The rats of the third group were not fed in some of the first atttempts but they were fed in some of the last attempts. *It was seen as the result of these* experiments that the rats of the first group, in comparison to the other groups, learnt to come out of the puzzle-box in the shortest time. The rats of the second group could come out of the puzzle-box only after making many efforts. The rats of third group began to show progress in learning as soon as the feeding began and started coming out of the box very soon. Through this experiment, the fact was clear that, although the rats learnt to come out of puzzle-box even in the absence of a reward, yet the reward helped them in learning to come out of the box. Here Tolman, *laying great stress on the learning of the rats of the* second group, has said that they could learn to come out of the puzzle-box even in the absence of a reward or motivation. It is clear that motivation is not unavoidable for learning. On the other hand, Tolman acknowledges the effect of motivation in learning. *It can be seen, in connection with the rats of the third group, that although they had learnt to come out of the puzzle-box,* they were yet not expressing it in the absence of motivation

The experiments made by Reynold, Spence and Lippit have raised a doubt in the truth of the conclusions reached by Tolman in his experiments given above Spence and Lippit also made experiments on the rats through the medium of a special kind of puzzle. The rats in this puzzle were constantly allowed the facility of reaching food and water. Through many experiments, the rats were taught that in the puzzle-box there was food in their left and water to their right After teaching this, the rats were kept thirsty for some time and then were let loose in the puzzle-box As soon as they were free, they atonce ran towards the route to water. Next time they were kept hungry for sometime therefore when they were allowed to enter the puzzle-box, this time again they ran towards water. In explaining this behaviour of the rats, Spence and Lippit stressed the fact, that in the first instance, the rats had taken the route to water, and therefore on the second occasion too, although they were hungry, yet they ran towards water because a necessary cognitive structure to take the route to food could not be formed in them This disproved the idea that an organism learns with the help of demand and expectation

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Through the above experiment, the latent learning theory of Tolman appears doubtful. Enough experimentation to reach a definite conclusion could not yet be made,

(2) Associative Principle—According to Watson, an organism learns to respond to a specified stimulus. An organism learns the signs to achieve some specified goal. Its behaviour cannot be explained by regarding it a mere chain of responses. When a rat is put into such a puzzle-box in which there is food in the centre, it learns the different signs to reach the food. By learning in this way, a cognitive picture of the situation is formed in its brain. To prove the validity of the sign gestalt theory, Tolman has referred to many experiments on place, learning and reward, expectation etc. It was proved through experiments on place learning, made by Tolman and his companions, that a rat recognises the various signs on its route to reach a goal. In one experiment, there were three routes of different distances to reach the food. Now, when the rat was let loose, it learnt to reach the food by the shortest route When the route was closed, it learnt to reach the food by a big route. This experiment shows that a rat also follows the minimum effort theory in learning. It aims at discovering the shortest way to reach the goal.

As has been said before, Tolman, to prove the validity of his theory, refers to the reward expectancy experiment. A psychologist, named Tiklepaugh, in one of his famous experiments, showed some monkeys two pots, one containing a banana and the other containing nothing. Both the pots were covered. Now, when a monkey was given an opportunity, he always recognised the pot containing banana and opened it. Later the banana was removed from the pot and some beat root leaves were placed in it instead which a monkey does not like. When the monkey opened the banana pot and found the leaves in it, he did not take them. Through this experiment, Tolman wants to say that an organism does not make some specified response, but only to specified signs.

(3) Reinforcement Principle—Thorndike and Pavlov lay special stress on the effect of reinforcement in learning. According to Tolman, learning is high when the sign significate expectation is strong. If expectation of an organism is confirmed, through some special sign, the sign gets fixed in its brain. On the other hand, if the expectation, through some sign, is non-confirmed, the sign becomes weak. In this way, an organism recognises the importance

of some specified sign through confirmation and non confirmation. Tolman, while explaining this fact, has said that the strength of field expectancy depends on various intervening variables such as immediate action, motivation and repetition etc.

Osgood has raised the following two objections against the reinforcement principle of Tolman

(a) How can a cognitive relation be established among expectations ?

(b) Expectation for an organism comes after an action, how, therefore, can it be weakened or strengthened by its former attainment ? Tolman has given no satisfactory answer to these objections raised by Osgood

(4) **Action Principle**—This is Tolman's fourth theory in learning According to it, there should be an adequate demand on the part of an organism to learn some action. Along with this demand, the experience of an organism also helps in discovering an adequate response. Due to its experience, an organism has some expectation from its specified response. If this expectation is confirmed by this response, the organism learns this response. In this way, according to Tolman learning depends on demand and expectation

Evaluation of Tolman's Theory—Through an argumentative analysis of the different theories of learning, Tolman noted that every theory was based on the study of a special problem and no attention is paid to any other problem Therefore, in order to save his theory from being one-sided, Tolman acknowledges different standards of learning. Among these, learning through a connecting response belongs to the lowest standard, because it only establishes a relation between some stimulus and response. Trial and error theory is of a higher standard than this, because in this theory, one of the many presented alternatives has to be chosen Learning through insight is the learning of the highest standard According to Tolman, all these standards of learning can be explained through the sign gestalt theory In this connection, Tolman advocates the following three theories to explain learning

(1) Capacity Law

(2) Law relating to the nature of material

(3) Law relating to the manner of presentation

Tolman has mentioned many sub laws to the above laws According to him, learning depends on the learning capacity of an

organism and the complexity of learning. Individual differences are found in the ways of learning due to the difference in learning capacity of different organisms. In other words, organisms with different kinds of learning capacity acquire different standards of learning.

(4) Reinforcement Theory—Clark H Hull presented the reinforcement theory to explain learning. This theory therefore is also called the Hull theory. Hull gave no importance to consciousness in learning. He has presented Behaviourist and Instrumentalist explanation of learning. Practice is of special significance in instrumental learning. Hull has explained complex learning on the basis of simple learning as the other behaviourists have been doing. But, on the other hand, Hull has an opinion different from that of other behaviourists like Watson etc. in many things, For example, Watson, in the law of results by Thorndike, does not accept purpose and insight etc. in learning; whereas Hull accepts their importance in learning. Contrary to the Tolman's view, Hull does not accept the view that a sign or significance is learnt in learning. According to him, in learning, an organism learns to respond to a stimulus. An organism collects learning gradually on the strength of practice. According to Hull, the process of organism, effecting collection, depends on its practice. There is an important effect of reinforcement condition on the practice. In this way, his theory is called goal gradient or reinforcement gradient. It can said to be a refined form of the law of effect of Thorndike.

Like Watson, Hull also gives a molecular explanation of the behaviour in learning. Here his opinion is against the opinion of Tolman, but Hull has regarded the molar and molecular viewpoints as objective and not subjective.

According to Hull, the importance of motivation in process of learning is very great. Motivation does the work of a drive in organism. An organism cannot learn anything in the absence of motivation. It is motivation on account of which it performs some specified action. This motivation, on the one hand, forms a habit resulting from practice and, on the other hand, it is a source of practice in performance. When an organism lies inactive, it does lack practice, but there is an absence of motivation. This motivation may be about food, freedom from some painful condition or about any other thing. As soon as motivation arises, the organism becomes active. In the presence of motivation, the actions

of an organism are goal directed. When it gets a reward in acting in a particular way, it repeats the same action and, in this way, the specified response is confirmed by the reward in the form of motivation. On the other hand, the tendency *of repeating the responses,* which are not rewarded, is weakened. In this way, reward strengthens the relation between stimulus and a response in an organism. It is this reward which is called reinforcement Hull has accepted reinforcements of two kinds-primary and secondary. Primary reinforcement means those stimuli which affect some motivation in *a direct form* For example, for motivation of hunger, food does the work of reinforcement, and the action, which brings food to the organism, is repeated in the organism The other kind of reinforcement is secondary, an example of which is watering of the mouth on seeing food.

Goal gradient or reinforcement-gradient is the central point of Hull's theory. His theory is therefore called reinforcement theory. The attainment of goal brings stability to the relation between stimulus and response. It reduces the tension of the organism which helps it in learning the specified response. For example, when a hungary rat is let loose in a puzzle-box, it learns to take the shortest route to food, because it brings a ready reward.

As has been said before, Hull, like Thorndike, accepts the importance of practice in learning When an organism repeats the specified response to some stimulus again and again, a close relation is established between them According to Hull, along with practice, *reinforcement is also necessary here In the absence of re*inforcement, a mechanical practice alone is of no use Needless to say that Hull's opinion here is different from Thorndike's mechanical theory of learning. Hull also agrees with other behaviourists that learnings of all kinds can be explained on the basis of connecting response. Hull has presented 16 laws to explain the different aspects of learning, among which the laws of motivation and reinforcement are the chief laws and the other laws are derived by these two laws. Hull has expressed his theory with the help of the following formula :

$$S E R = f(H \text{ and } D)$$

In this formula, capacity of response has been shown by the letter S, to determine practice by H and motivation by D. Middle reinforcements have special importance in the process of learning.

Hull has accepted physiological and physical reinforcements in learning. He does not accept reinforcements of other kinds.

According to Hull, there are two main aspects of the transfer of learning, one of which is limited by stimulus and the other by response. The transfer limited by stimulus has been explained through generalisation, and the transfer limited by response is explained through habit family hierarchy. When an organism fails in some situation due to some specified response, it tries some other response which previously brought success to it.

Similarity in the Theories of Hull and Tolman—

As is clear from the aforesaid explanation of Hull's theory, there is no concept, specially new, in it except the concept of reinforcement. So far as the question of the importance of reinforcement is concerned, the psychologists do not deny it. But Hull could not prove his theory through experiments. A psychologist, named Finan, through his experiments, has supported the Hull's theory of reinforcement in learning. But, in opposition to Hull, Tolman does not consider reinforcement as necessary for learning. The main objection raised against reinforcement theory was that, if a response of an organism in learning is established be reinforcement, how does it learn in the condition of pain. Secondly, Hull's theory, however true it may appear about the learning for rats, cannot be taken to be true about the learning for a man. Hull has not been able to give a correct answer to these objections. The importance of his theory lies in the fact that he encouraged various new experiments to be made about learning.

Hull and Tolman, both try to tell about the rats as to why they make a choice on presentation of alternatives at the time of discovering a route to the puzzle-box and what they learn in doing so. In this way, their theories are the attempts to explain 'why' and 'what'. In the process of learning, there is a response to some stimulus. Various intervening variables work in the establishment of a relation between stimulus and response. Hull and Tolman, both accept the importance of these intervening variables and try to explain them. Both these psychologists consider learning different from performance.

Difference between the Theories of Hull and Tolman—

Inspite of the above similarities, there are the following differences between the theories of Hull and Tolman.

(1) Hull has explained the process of learning on the basis

of reinforcement. According to him, the organism picks up a practice of repeating a specified action on account of reinforcement. The organism learns a proper response to the goal of reinforcement. On the other hand, according to Tolman, the organism learns, not the response, but the sign or significance of a stimulus. In other words, it learns the kind of response which should be made on presentation of a particular kind of sign In this way, it learns a cognitive pattern. This very cognitive pattern directs it to its future responses

(2) According to Hull, learning can be explained by defining Thorndike's law of effect On the other hand, Tolman's law of effect is the law of performance and learning cannot be explained through it

(3) Hull has regarded incentives necessary for learning. On the other hand, although Tolman accepts the importance of incentive in learning, yet he does not consider it necessary for it.

(4) According to Hull, reinforcement theory works at the root of all kinds of learning. According to Tolman, there are various ways of learning, and all kinds of learning cannot be explained through any one theory

(5) Hull and Tolman, both accept the different forms of intervening variables According to Hull, all the intervening variables have one and the same form, because learning also has only one form On the other hand, because Tolman accepts many forms of learning he accepts variables also to possess many forms. While Hull has accepted only the physiological and physical variables ; Tolman, besides these, accepts also the psychological variables.

It is clear from the aforesaid theories of Hull and Tolman that while Hull has given special importance to stimulus, Tolman has given importance to response. Otherwise, in other things, both these psychologists have been supporting one and the same fact in two ways. Whereas Hull's attempt to explain the laws of learning through mathematics provides a scientific basis to the theory of learning, Tolman has, by accepting various forms of learning, reduced the controversy among different theories

Q. 66 Write a short note on—Transfer of Training.

(Madras 1969; Banaras 1965)

Ans. It is a matter of common experience that we are facilitated in the learning of something new by some previous learning. The son of a businessman is proficient in the arithmetic class because

of his training in accountancy in the shop. Transfer of learning implies the use of learning from one situation to a new situation either in part or as a whole. In this way, a knowledge of mathematics assists in the study of physics and chemistry.

Types of Transfer :

Commonly, there are two types of transfer of learning. These are as follows :—

1. *Positive Transfer of Learning* : In this type of transfer the effect of the training on the new type of learning is favourable or positive and learning is enhanced. For example, one group was taught Latin while another was not. Both the groups were constituted of students possessing similar interests and intelligence. Now, they were taught English for equal lengths of time together and the result was that the group equipped with the knowledge of Latin took less time and gained comparatively more skill. The reason for this is the positive transfer of the training in Latin to the learning of English.

2. *Negative transfer of training* : The training received in the learning of one thing hinders the learning of a new thing and it is accordingly classified as negative. For example wrestlers are weak in studies because wrestling consumes too much of their energy to leave any for studying. Thus, wrestling is a hinderance in studying.

On some occasions, learning or training has no effect as for example, the memorisation of a poem in Hindi does not affect a similar treatment of Geography. In such a context, there is no transfer of training. The transfer of learning should affect in some way or the other, the acquisition of new knowledge. If the transfer is suitable it is positive and if it is detrimental it is negative.

Some Important points about Transfer

The psychologists tried to discover the conditions which favour the transfer of training and in this context, many experiments have been carried out. Some of the important things discoverd are—

1. *Transfer value of the subjects is dissimilar* : Experiments carried out on the subjects taught in the schools indicated that their transfer values are dissimilar. As it is, modern psychology does not accept any subject as a training of the mind, but in spite of this fact, the transfer value of Physics and Mathematics is rated very high. The next positions are occupied by Languages and

Social Sciences While English and History have no transfer value, cooking, sewing and dancing have negative value, it being implied that they are a hinderance to the study of difficult subjects

2. *Transfer is not general but particular*: The statement about the transfer value of science and language should not be taken to mean that these subjects help in the learning of any and every other subject Actually, transfer takes place only in similar circumstances The knowledge of Sanskrit may assist the learning of Hindi and English because of the extensive use of Sanskrit words in these languages, but this knowledge may become an obstacle in the study of Urdu and Persian instead of being useful. It could create a problem in pronounciation

3. *The study of transferable subjects is essential if any transfer is to be affected*: If it is desired to affect a transfer of a knowledge of Sanskrit, it is better to study Hindi or Bengali while a similar treatment of Latin makes the study of English facile

4 *Transfer depends very much upon the intelligence and innate efficiency of the learner*: This fact has been mentioned earlier. It has been observed in experiments that the capacity for transfer of training in one percent of the highly placed high school students is twenty times than that of the capacity of one percent of the lowly placed students of average intelligence Similarly, a person makes use of his training due to innate qualities, thereby making transfer possible.

5. *Transfer is due to a similarity of material and methods*: As has been mentioned before, transfer of training is possible only when the material and methods of the subject to learn coincide with those of the subjects learned, as exemplified by the use of Arithmetic in Accountancy

6. *Transfer depends upon the use of facts learnt*: It has been mentioned before that transfer is not possible unless the subject learnt is put into practical use The transfer of the knowledge of Ethics gained in school to Social Education is possible only in the event of the student's use of the former daily life

It is clear from the description of transfer that it depends on the intelligence of the learner, and innate efficiency, practical capability and use of the acquired knowledge Transfer takes place in the subject of similar matter and methods, and the teaching of it. Transfer value differs from subject to subject While some have transfer values others affect negative transfer

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14

Attention and Interest

Q. 67. What do you understand by attention? Give an analysis of its conditions. *(Delhi 1966)*

Ans. Attention is a selective process. Man lives in an environment. The stimuli from the environment are always affecting him. But these stimuli do not affect him equally. It is a common place observation that some stimuli affect us more than others. This shows that man selects out of environmental stimuli. This tendency of selection shows that there is a motivational process in him which is known as attention. This attention is affected by interest, attitudes and set. It is a selective process which includes motivation, set and selection. The cat will not attend to the mouse, one can see a definite set in it. This set is both physical as well as mental. To take an example from human beings, if a student is not motivated, he will not attend to the class lecture. Again while a professor is delivering a lecture in the class, there are several other sounds being made in other rooms and the surroundings. The student who hears the lecture selects professor's voice out of the noise in the surroundings. While a student is attentively hearing the lecture, one can very well note his physical set which is also symbolic of his mental set Receptor adjustment, bodily adjustment, postural adjustment, muscle attention and central nervous adjustments are typical of bodily attitude in attention. Thus in brief, attention can be defined as a process which compels the individual to select some particular stimulus according to his interest and attitude out of the multiplicity of stimuli present in the environment.

CONDITIONS OF ATTENTION

As a selective act of the mind, attention depends upon several conditions. These conditions may be of two types—External or Objective and Internal or Subjective. External or objective conditions are related with the environment. In the environment or surrounding of the individual there are several stimuli, but he does not attend to all of them at the same time, because some stimuli

are stronger than others. The factors making these stimuli stronger than others, are known as external determinants of attention. Besides the external conditions the mental conditions, culture and heredity also influence attention. Due to these internal conditions *some objects attract our attention more than others. These* internal factors are internal determinants of attention. The methods of achieving attention are based upon these external and internal determinants of attention

EXTERNAL DETERMINANTS OF ATTENTION

The following are the most important external determinants of attention :—

1 *Nature of Stimulus* : Nature of stimulus means its type, *i e*, whether it is visual, gustatory, auditory, olfactory or tactual stimulus. It has been found by experiments that in comparison with other sensations, form, colour and sound attract more attention Among the pictures, the pictures of human beings attract more attention than those of animals or objects. Among the pictures of human beings those of beautiful women attract more attention Besides these, the coloured pictures attract more attention than colourless ones All these factors are important in advertisement. In the auditory stimulus, the melodious voice attracts more attention than other voices

2. *Intensity of the Stimulus* The intensity of the stimulus is a helpful condition in attention In comparison with the weak stimuli the intense stimulus attracts more attention of the organism. High sound, excessive pressure and acute pain attract our attention In the market there is always some buzzing sound and yet the pedestrians hear the horn of the motor car since the sound of the horn is louder than other sounds But it is not always necessary that one should attend to the intensity of stimulus Sometimes while walking on the road calling of our name attracts so much attention that we fail to hear even the loud sound of the motor horn As a matter of fact the attraction of the attention does not depend on any single factor but on several factors interconnected with one another Hence it can be said that other things being the same the more intense stimulus will attract more attention

3. *Size of the Stimulus* In the visual stimuli the size of the stimulus is also a determinant of attention As a general

bigger size attracts more attention, but a small advertisement on a very wide background also attracts attention. Thus the attraction of an object does not depend upon its size alone, but also on its background. To illustrate, a big black spot on black face will not attract so much attention as a very small black spot on a white face.

4. *Location of the Stimulus* : The location of the stimulus also affects attention. In the visual stimuli, the most effective location is just in-front of the eyes. The role of different pages in the news papers or the magazine and the different places on the same page, is important in advertisement. It has been found by experiments that advertisements given on the front page or on the upper half of any page attract more attention.

5. *Contrast of the Stimulus* : The contrast of the stimulus is also an important determinant of attention, *e. g.*, the presence of a woman among men and that of a man among women definitely attracts more attention.

6. *Change of the Stimulus* : Attention cannot be concentrated for a long time on some particular object. Hence the change of the stimulus affects attention. Attention is sustained by change of the stimulus. The advertisers change their advertisements from time to time lest they may cease to be attractive.

7. *Isolation of the Stimulus* : A man sitting alone in some corner of the park, hotel or club attracts more attention than others. A student sitting alone at the far corner of the class, is seen first. Thus isolation is an important external determinant of attention. This fact is based upon the reason that the isolated individual is not mixed with other individuals and hence seen separately in his own background. By experiments in advertisement it has been found that only the fact of isolation attracts 30% more attention. In the British Journal of Education Psychology of August 1951, D. B. Berlyne points out the following principles based upon latest experiments :

(a) In comparison with the un-changed stimulus the stimulus changed in the near past has more possibility of attracting attention.

(b) The effect of the change goes on diminishing with the passage of time.

(c) Whenever stimuli are changed together and in which one is left un-changed, the effect of change is not noticeable.

(d) *If change goes on in the changed stimuli, the process of attention is permanent and strong.*

The modes of change also influence the process of attention. If there is a change absolutely opposite to the present stimulus, it will definitely attract more attention. While studying one does not hear the sound of the clock or that of electric fan but if either of these suddenly stops, one cannot fail to attend to it. Man becomes used to regular changes and does not pay much attention to them. But if some irregular change or any sudden change occurs, it at once draws attention

8. *Duration of the stimulus*: As a general rule the stimulus *having more duration, attracts more attention. Thus duration* of the stimulus is an important determinant of the attention But sometimes the smallest flashing of a movement attracts more attention than the bigger stimuli, *e.g.*, a sudden flash of light for *several seconds will attract more attention in a dark night than a* continually burning lamp.

9 *Repetition of the stimulus* · Along with duration, repetition of the stimulus is also an important determinant of attention. It is a common place observation that when the teacher has to attract the attention of students towards a particular phenomenon, he repeats it several times But sometimes man ceases to attend a phenomenon simply because it is repeated many times, *e. g*, if a man says some t hing about him, we take interest in it once or twice, but if we find that he always repeats the same thing, we cease to pay attention to it

10. *Movement in the Stimulus* In comparison with the static, the moving stimuli attract more attention. The position of stimulus change due to movements. An object lying in some corner of the room will not attract our attention, but even if there is some illusion of movement in it we cannot help attention to it. The influence of movement in stimulus is widely used by the shopkeepers and businessmen, who advertise through moving electric lights

Internal Determinants of Attention ·

The conditions of attention as described so far are the external determinants of attention They can also be called external laws of attention. The presence of these conditions in the environment is helpful for attention. Besides these external conditions,

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Internal Determinants of Attention :

The conditions of attention as described so far are the external determinants of attention They can also be called external laws of attention The presence of these conditions in the environment is helpful for attention. Besides these external conditions,

some internal conditions are also helpful in drawing attention. These conditions are related to motives. As a matter of fact the influence of conditions depends on these internal conditions to a very great extent. The hungry man will attend to the form and stimuli of the food. A man with a full belly will not attend to food, however nice it might appear. In the advertisement those demonstrating the naked organs of the woman have the maximum power of attraction of attention. Those interested in cinema look to the advertisements of cinema at first sight. It is difficult to describe all the internal conditions helpful in attention. Hence only the most important will be enumerated here :

1. Interest : Innate and acquired interests draw the individual's attention to a particular object. Doctors, engineers, professors, all attend to the object of their own interests. Even among the professors an object attracting the attention of a professor of geology need not attract the attention of a professor of philosophy as well. Thus the innumerable differences in interests create innumerable determinants of attention in different men. The stimuli influencing innate tendencies attract more attention than those influencing acquired interest.

2. Basic Drives : The basic drives or instincts of the individual are also important in drawing his attention. The animal attends to a particular stimulus when driven by the basic drives of hunger, thirst, sex, etc., *e.g.*, a normal man motivated by sex will naturally attend to individuals of opposite sex. We all know by experience that when hungry we may attend to even a distasteful object, but while our belly is full, we may not attend even to the most tasteful food. Among the instincts, the fear has got a definite influence upon attention All men who fear snake will attend to all things resembling the snake Like fear, curiosity also influences attention. We attend to even the smallest details of the object about which we have curiosity.

Innate need also is very important in attention. The influence of sexual need in attention is very much exploited in the advertisements. Normally the sexual need in human beings can be easily evoked. Hunger, thirst etc., are felt occasionally and the means to satisfy them are also readily available, but neither the sexual need is ever fully satisfied nor are the means of satisfying it available to all persons all the time. Hence most of the advertisements draw attention by stimulating the sexual need in human beings.

3. *Mental Set*: Mental set is one of the most important internal determinant of attention Mental set means the tendency or attitude of the mind. A man will attend to those objects to wards which his mind is set. In the days of examinations, the mental set of students is generally towards the examination and hence even the smallest thing concerning the examination will attract their attention.

4. *Aim*. Aim also influences attention. Every man has some immediate and some ultimate aims *e. g.*, the immediate aim of the students is to pass the examination while the ultimate aim may be to get a job to earn living or any thing else The man whose aim is not to pass the examination will not be concerned with text books or notes etc., but one who has the aim to pass the examination will at once attend to them

5. *Meaning*: In comparison with meaningless things, meaningful things and talks attract more attention. A man will not attend to a thing which has no meaning for him Men do not like to hear meaningless talk. If some persons are talking in Tamil, the Punjabi will not like to hear it since for him it has no meaning.

6. *Habit*: Habit is also an important determinant of attention. If a man is habituated to rising early and winding his clock early in the morning, he must attend to the clock as soon as he gets up It has been rightly pointed out that man learns as to which objects he should attend to and to which he should not, and thus develops habits of attending and not attending to things. Thus habit has two aspects in relation to attention On the one side man develops a habit of attending to necessary desirable things and on the other side he develops the habit of attending to unnecessary and undesirable things Both these kinds of habits help man in his daily routine

7. *Disposition and Temperament*. Both disposition and temperament are important internal determinants of attention, *e g.*, a man having a religious disposition and rational temperament will attend to religious matters, while another person having a sexual disposition and passionate temperament will attend to matters concerning sex or crimes etc. William James has rightly pointed out that it is our tendency to take interest in particular things, a result of our innate disposition and mental development, that determines as to which among the crowd of sensations, should attract our attention.

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2. **Involuntary Attention**: As has been explained above, involuntary attention is not only directed by the individual's desire or motivation, it may even be against it. It hinders the process of goal seeking sometimes, not always. If, for example, your attention is attracted by a song while you are studying, your studies will be hindered. Social adjusment is similarly obstructed by involuntary attention The proper adjustment of a student can be the outcome only of an undisturbed attention to his studies. On account of the fact that one can pay attention to only one thing at a time, the student will not be able to attend to his studies if his attention continually wanders in other directions. Obviously, a person forgets his goal owing to involuntary attention and cannot effect his adjustment

3. **Habitual Attention**. Besides the two types of attention mentioned above, there is a third type, the habitual or non-voluntary attention. The difference between non voluntary and involuntary attention is that the former type is the result of some habit or practice and the motivation is in the individual but the reason for attention in the latter type is in the object Habitual attention is different from voluntary attention because habitual attention has no need for a desire as the latter does But continued application of voluntary attention converts it to habitual attention For example, a student pays voluntary attention to study in the beginning but it is gradually transformed into habitual attention towards reading or writing. Thus the position of habitual attention is in between voluntary and involuntary types of attention

Actually the above distinctions made in attention are not very clear. The difference between voluntary and involuntary attention is often only just discernible No attention can be said to belong to any one of the three types completely. A scholar has to exercise his desire inspite of his involuntary attention in reading. There is

8. Past Experience : Past experience also affects attention. If we know it by our past experience that a particular person is sincere towards us, we shall pay attention to whatever he advises us. If we know by experience that he is not sincere to us, we shall not attend even to his most serious advices.

9. Emotion : Emotion is also an important determinant of attention. It is a matter of every day experience that we attend even to the smallest fault of the person whom we hate while we do not attend even to the greatest blunder of a person whom we love. A mother seldom finds faults with her child. The lovers find the whole world singing and dancing and immersed in romance.

10. Social Motives : Social motives are very important determinants of attention. In advertisements the human figures attract more attention than figures of animals and things. The reason is that man is guided by his social motives. The news about altruism, bravery and saving another's life by putting oneself in danger attracts our attention because we praise these qualities. Men attend to things concerning their duties because of social motives.

Besides the conditions described above, many other factors influence attention. Heredity, education and training have a wide influence on attention. The family, school, club, class and society of which an individual is a member, do have some influence on his attention. The physical condition, desire, purpose of the person concerned also affect his attention. Thus all the factors affecting the personality of a man affect his attention as well. As a matter of fact it is difficult to describe all direct and indirect determinants of attention. The description given however, includes the most important of such factors.

Q. 68. Distinguish between voluntary and involuntary attention. Can attention be divided between two distinct tasks at the same moment ? *(Bombay 1958; Nagpur 1955)*

KINDS OF ATTENTION

1. Voluntary Attention : Voluntary attention (its name is indicative of its nature) is that attention which is willingly directed to an object. If, for example, a student attends to his studies of his own account and as a result of any external pressure, his attention will be called voluntary attention. An analysis reveals elements of desire and interest, aim and social adjustment in this voluntary attention. In the foregoing example the student directs his attention because of particular aim like the passing of an exami-

nation, acquiring knowledge or one of a number of other goals. He takes an interest in studying. By passing the examination or acquiring knowledge he may be able to support a family or gain social standing and status. Like other activities, attention, is just another form of adjustment. The difference between the voluntary and involuntary attention is that while the former is secured by the motivating elements in the individual, the motivating elements exist without in the latter case. Thus, when attention is suddenly attracted by a song, the attention is called involuntary.

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an unconscious desire to pay attention to an object which involuntarily draws your attention. In this way the difference in the types of attention is small though it is of great importance from the psychological view-point.

The nature of attention permits of its concentration in only one direction at one time. Direction of attention to two or more objects means either their acceptance as one or such an oscillation of attention between all of them as gives the impression of simultaneous attention. But experiments have proved, beyond doubt, that a person can pay attention to only one object at a time.

Q. 69. Write a short note on—Distraction.
(Poona 1962, 60; Karnatak 1966, 64)

Ans. Distraction means the dividing of attention or some interference in attention. For example, when one is studying, the sound of a song or noise breaks in upon attention. The object which causes the distraction is called the distractor. In fact, broken attention is not the absence of attention because the distractor is associated with the activity, often, though not always, and it no lònger inteferes with the activity.

Distraction does not always interfere

Thus, the notion that distraction invariably hinders work is misleading, it being seen, for example, that the labourer produces more when there is music. Some labourers, men and women, sing at work in view of this fact. Not a few people do their reading and writing while the radio is playing. Some people work better in a noisy environment than in a peaceful one. Experiments conducted by Morgan indicated that at first distraction caused a drop in the speed of typewriting but it latter became constant. Pursuing the work in the disturbed condition increased the speed and it again dropped when the distraction was removed. But distraction in some experiments by Weber caused harm. Though it cannot be definitely said that distraction increases the speed of the work, it is possible to say with some degree of confidence that a decrease in speed due to distraction is not inevitable. Actually, the effect of a distraction on some work depends in no small measure upon the capacity, interest, practice, skill and mental set of the worker. If the distraction is suitable the speed will be increased but if it is unsuitable the speed will drop.

Forms of Distraction

Roughly, distraction can be divided into two forms:

1. Continuous Distraction As the name suggests, it is the continuous distraction of attention Some examples of it are the sound of ratio or gramophone played continuously, the noise of the market place etc. Experiments have led to the conclusion that adjustment to continuous distraction takes place quickly.

2 Discontinuous Distraction: This type is irregular, being interspersed with intervals *e.g.*, the hearing of somebody's voice every now and then. It interferes with work because of an impossibility of adjustment.

Means of removing Distraction

Some major means of removing distraction are:

1. Being active in work. Work in distraction calls for more energy, so that one way of adjustment to it, or removing it, is to become more active in work

2. Disregard of Distraction· The presence of a distracting factor while a man works is no extra-ordinary condition, and so, the best way to remove this element is to disregard it. The distraction is effective only when attention is directed to it, so that in attention, even the most serious distraction, will keep the activity from being interfered within any way

3. Making the distraction a part of the work: Distraction is an obstacle only when it is distinct from the activity or against it since atteation can be focussed just on one object at one time Therefore, another method of making a distraction ineffective is to make it a part of the work Some people work better when listening to a song because they make it a part of their work But this approach is very difficult because in this the interests, nature and capacities of the person are involved It is very difficult to make an uninteresting and contradictory distraction a part of the work.

Q. 70. Can attention be identified with interest?

(Bombay 1969)

Ans. Attention is selective act of the mind. To attend to a thing is to concentrate on it by removing attention from other thing The mind can attend to one thing at a time Hence mind has to select. In the selection it is natural that the mind should select s objects in which it is interested This is amply demons[illegible] in daily life. The boy whose interest is in playing will

question arose as to how many stimuli an individual can pay attention to at one time. This will depend on the span of attention of an individual. Different psychologists have reached different conclusions about the span of attention through their experiments. According to A. Tucker, span of attention is limited by six articles. According to Charles Bonet only six stimuli can be attended to at one time. Other psychologists have found in some individuals a span of attention from 11 to 12 articles. Through his experiments made with the help of pebbles, Hamilton saw that the span of attention of a subject was limited upto six or seven pebbles. When the pebbles were placed in a group, the span of attention was found to be greater. Jevons was the first to say that the span of attention is different with different individuals and that in one and the same individual, the span of attention is different on different occasions. In this way, the span of attention is variable. The span of attention in children is less than that in adults. Apart from age, practice, physical condition, liking, mentality and the form of the object of attention also affect the span of attention. Their difference in different circumstances can create difference in the span of attention.

Experiments have been made with the help of different kinds of stimuli, in order to measure the span of attention. Most of these experiments have been in connection with the visual span of attention. In an experiment, first of all some words or figures are written on some slides. Now these slides are gradually presented before the subjects through an apparatus to measure span of attention. It is so arranged that a slide may be seen at the most for one tenth of a second so that the subject may not be given a chance to move his eyes more than once. The subject has to tell what word or figure he has seen. This is the span of his attention. The subject is given many chances and their average is taken out. Cattell was the first psychologist to carry out an experiment to measure the span of attention in the year 1885-86.

It is clear from the aforesaid explanation that more than one stimulus are included in the span of attention. In connection with the question why it so happens, it has been explained that we see the different stimuli in the form of one group or pattern. It has been found out from the experiments made by Freeman that in a condition of simple groupism, the span of attention is greater.

Q. 72. Write short note on—Division of attention.

It is a matter of common experience that an individual sometimes does two or *three acts together. For example,* people sing while they are taking a bath; women knit while they are gossiping and many people keep eating ground nuts while they are seeing a cinema, such two acts are possible at the same time because attention is divided between them. In this division, attention cannot be paid to both the acts in an *active form. Ordinarily, if you* pay attention to eating ground-nuts, you will not be able to see the cinema. Seeing of a cinema is possible only when your acts of *eating ground-nuts is mechanical. It is* also true in all those conditions in which any two acts are done together. Out of the two acts, if one is made mechanical, you need not pay attention to it and it goes on by itself. This depends on practice. Even two complicated acts are possible at one and the same time through *practice. But, if the acts is difficult, attention in such a condition* is often diverted and not divided It means that attention is very quickly diverted from one thing to the other, although we donot actually feel this diversion Guilord, while giving an example of doing two acts by making them a single pattern, writes in his book that when a person has learnt to play on piano with both the hands separately, he can also play on piano with both the hands together

Here a question arises as to what is the effect of the division of attention on that act. Some psychologists maintain that the *effect of the division of attention on the production of work is* harmful, while others say that it is useful. In one experiment, Michell asked the subject to compare two weights and to count the number of ringing sounds upto six at one and the same time. At first, the act of counting was some what disturbed, but later, the act of comparison also, along with the act of counting, was good. Psychologists have concluded, from some other experiments of this kind, that, by doing two acts together no hindrance is caused in the product, *but it is, on the contrary, more convenient and there is an increase in production.* It has been seen through the experiments that the acts of knocking, reading and adding, when done together at the same time, are more satisfactory than when done separately at different times But evidences in favour of the division of attention are not available through all experiments Paulham, by allotting a subject the act of reading one poem and c writing another, saw that some disturbance or the other w

caused in doing both the acts together. Similar conclusions were drawn from the experiments made by Binet. Laurange saw through his experiment, made with the help of the apparatus measuring span of attention, that the division of attention reduces the span of attention. Spetch, on getting the act of counting done along with a free associative experimentation, saw that the division of attention had a bad effect on the form as well as on the result of work-product.

It is clear from the above explanation that all psychologists do not reach similar conclusions of experimentation about the effect of the division of attention on work-product. The truth is that the effect of the division of attention on work-product depends much on the ability, liking, practice and the form of actions of the subject. There are certain actions which can be easily performed together, and, on the other hand, there are certain actions which cannot be performed together. For example, to solve a difficult mathematical question and to understand some difficult portion of a poem is not possible at one and the same time. It is so, because no one pattern can be made of such un common actions. On the other hand, those actions, a pattern of which can be formed, are done together better than they are done separately.

Memory and Forgetting

Q. 73. **What is memory? Analyse the factors in memory and briefly indicate their nature.** *(Poona 1965, 66, Patna 62)*

Ans. The conscious level of the human mind is not the solitary level of mental activity. The impressions of various experiences become permanent at the subconscious stage and they come to the conscious level whenever they are needed or when there is that relevant context. The experiences are not obliterated from the mind with the passage of time, but rather, they remain in the mind permanently, in the memory and can be recalled with effort and recognised. But, it is common experience that people do not remember their experiences completely, and a major part is not remembered and it is forgotten. Thus remembering and forgetting are subjects of daily experience. Memory is a geneal word which includes several mental activities like recall, recognition or retention. We see indications of memory all around us. A person or animal experiences ease in relearning an activity which he had learnt previously but had forgotten. This proves very obviously that the previous learning had not been wiped out completely but had left an impression on the mind or a change in the nerves which indicated relearning. People do not completely forget the story of any movie they have seen but recount it with ease when they are requested to do so by a friend. If someone else takes on the tedious task of telling the story of the same film, they affirm it because they are reminded of it, and if they hear any song from the film played any where they are easily reminded of that too. Thus there is retention, *recall and recognition in the memory of a perceived experience,* which makes it a complete activity.

Memory Is a Physical Activity

Bentley and his followers said that experience or learning *acquired by a person leave impression or marks on the mind,* which are memory traces. They are the [illegible] memory in the *form of functional tendency* [illegible] tion ends when these traces are wiped off. These psychologists have established by giving proofs that retention is a psychological process.

Memory is a Psycho-physiological Activity :

But Bartlett, Piron and Gibson and some other psychologists have attempted to show that memory is a mental activity independent of memory traces. They have proved by examples of stories, pictures, etc., that memory depends more on mental states like interests, motivation, biases etc. than on repetition of experience. This makes memory a mental activity. But just as every mental activity has a psychological base, so does memory has a psychological foundation. Briefly, memory is a psycho-physiological activity.

Memory is preceded by learning and therefore, memory has four processes in general. They are as follows—

1. Learning
2. Retention
3. Recall
4. Recognition

Two of these four activities namely learning and retention, are essential in memory. Recall succeeds learning but there is no recognition. Sometimes retention is followed by recognition without any recall. Besides learning and retention both recall and recognition are necessary for complete memory. Sometimes it is recall which takes place first to be followed by recognition but equally often the order of the two activities is reversed.

1. Learning—It will be quite in keeping with the context to give a brief description of each of these activities. As has been mentioned above, the first step or activity is learning. If the learning is good, memory will also be good. Thus the methods which assist learning do the same for memory. Learning creates memory traces on the mind, on the basis of which recollection is effected.

2. Retention—The second activity in memory is retention, which means making permanent the remains of experience. The remains of experiences are left on the mind in the form of memory traces where they are safe though they are acted upon by interest and other mental states. The proofs of retention are recollection, recognition and relearning. Though recollection is a proof of memory, its absence is not the proof of the absence of memory because a person often remembers something at a later date which had eluded him at the earlier occasion. Same is the

case with recognition because while its presence indicates memory its absence is no proof that there is no memory. If we come face to face with a long separated friend and find ourselves unable to identify him, we cannot take this to mean that all the experiences related to that person have been obliterated from the memory because the next moment we might be astonished when at last, we succeed in identifying him. The most convincing proof of retention is furnished by relearning in the absence of which retention cannot be accepted. If there is no progress in relearning it will be concluded that there was no retention. After experiencing any thing the activity of its consolidation goes on for sometime. This is proved by the fact that a poem will linger in one's brain for some time after one has learnt it, even though there is no effort to recall it. Students preparing for some examination would have experienced this activity

Levels of Retention .

Retention, as has been mentioned above, is the making permanent of the remains of experiences The different forms taken by these remains of experiences indicate that there are different levels of retention. Something remains on the fringe of consciousness and can be recalled into consciousness effortlessly About some things we feel as if these had been experienced yesterday and can be recalled at will. The same cannot be said of others which we forget and can remember only when some one reminds us of them or when some new event takes place In this way, efforts have to be made in order to remember things in the conscious, subconscious and unconscious level The facts in the unconscious cannot be remembered and can be recovered only by word association, dream analysis and other methods

3. Recall—The third activity in memory is that of recall It is the activity by which the remains of experiences made permanent, are brought back to the conscious level A student studies for his examinations all the year round and a major part of his learning is present in a permanent and healthy state in his mind While answering the question paper in the examination hall he recalls this learning existing in the memory and puts it down in black and white Though this recollection cannot be identical to the original learning, its matter resembles the original and a major part of the learning can be remembered in the same form [illegible] efforts are made. Actually, recall is something novel as

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a mere reproduction of the past experience or perception. In spite of the fact that it depends on retention, recollection is not fashioned entirely by it. It is not necessary that if retention is good recollection will also be good.

Nature of Recall

Ebbinghaus experimented to see whether recollection is creative or reproductive, *i.e.*, whether the person concerned puts something alien with the recollection or does he make a faithful reproduction. Ebbinghaus taught some senseless stanzas to some people and asked them to recall these stanzas after different time intervals. From the results he concluded that recollection is reproductive, a view with which Bartlett and his followers do not agree, and to prove their point they experimented with the recollection of a story. A student was made to read a story with care and was given to recall it fifteen minutes later. This reproduced story was given to another student to read and he, too, was asked to recall it. In this way, students were made to recall a story by this chain method and it was concluded that in the last reproduction, the conclusion and even names of the character had been changed.

4. **Recognition.** The last step in memory is recognition. Sometimes recall comes after recognition as, for example, when we recognise an old friend the moment we set eyes on him and then we are reminded of many things about him. On other occasions, meanwhile, it is recall which precedes recognition. Suppose that I am travelling in a train and I am confronted with the embarassing situation of someone asking me whether I had recognised him. I apologise doubtfully and confess my inability to recognise him. The person says, "When ten years ago we lived in Saket, Meerut, we were neighbours". And this statement starts a reaction, reminding me of my experiences of ten years ago. I then recognise the person, shake hands and start talking of this and that. This example shows that recognition sometimes follows recollection.

Recognition may either be definite or indefinite. A person recognises a friend immediately he sees him and is perfectly aware of everything about this person, this being an example of definite recognition. An example of indefinite recognition would be the inability of a person to remember the time, place and context in which he first heard the story which has just been related to him inspite of the fact that he recognises the story itself. The person

knows when, where, how and by whom, in fact everything, of the recognised subject.

In recognition, the recognised person or subject is separated from other subjects or people. When a person recognises a friend in a crowd, he distinguishes his friend from the rest. This differentiation has a lot of significance in recognition and the more exact it is, the better will be the recognition. And, recognition is impossible in the absence of differentiation Recognition literally means cognising again, and it is therefore the cognition of some subject seen before. Thus recognition comes after cognition.

Q. 74 Describe the conditions favourable to memorisation. What does good memory consist in? Name and illustrate some factors that help retention. *(Baroda 1954, Raj 1957, Agra 1967)*

Ans. To study the favourable conditions in memory, it is necessary to study the favourable conditions for learning, retention, recall and recognition. Consult chapter No 9 for the favourable conditions in learning

Favourable Conditions in Retention

Many experiments have been carried out on this [illegible] many physiological and psychological conditions have [illegible] in learning. Some of the main conditions which [illegible] are :

1. Nature of Material The following [illegible] material to be retained help in its retention to a [illegible]

(i) *Intensity* : The intensity of the [illegible] retention of a subject. Weak or indistinct [illegible] in the mind for any length of time Clear [illegible] membered with ease.

(ii) *Distinctness* Distinct [illegible] treme beauty or ugliness and such [illegible] time. We forget an ordinary person [illegible] for a long time if he be out of [illegible]

(iii) *Recency*. Recent [illegible] time and a diminution [illegible] of time.

(iv) *Meaning*. [illegible] the mind while mean[illegible] little effort.

2. *Duration* : A sensation which continues for a longer time, can be retained for a longer time in the mind. A sensation of a shorter duration will be, correspondingly, retained for a shorter duration.

3. *Amount of Material* : If the subject being persued is long it will be retained for a longer time while a shorter subject will take less time before it is forgotten. The amount of material to be learnt has a favourable effect on its retention, there being two reasons for the phenomenon. (*a*) A man has to make less exertion in order to learn a shorter subject, while a longer subject demands more effort and therefore, the retention is more lasting. (*b*) In the longer subject, as compared to the shorter, the person finds the meaning and relates the various parts of the subject together, all this is the power of retention.

4. *Amount of Learning* : The extent of retention is directly proportional to the amount of learning that is to say that retention will be more if the amount of learning is large. A subject studied more stays longer in the mind while one studied less will remain in the mind for a shorter period. Overlearning has a favourable effect on the retention.

But this does not mean that retention will go on increasing with the learning because after a certain limit disinterest, fatigue, and monotony may have a derogatory effect on retention. Therefore, the increasing and strengthening effects of overlearning confine themselves to a certain limit.

5. *Methods of Learning* : The methods of learning, too, do not fail to impress their importance on the retention of a subject. Learning by the whole method instead of the part method, the spaced method instead of the unspaced method and the active method instead of the passive method result in better and longer retention.

6. *Speed of Learning* : The faster the learning, the better the retention. This is the principle in accordance with which people learning faster seem to retain the subject learnt for longer periods as compared to the slower learners. For example, a child grasped mathematics later than his contemporaries, but when it came to language, making no pretensions he was far quicker at it. His retention of language was far more than that of mathematics. Actually, the speed of learning indicates the inclination of the boy

owards a subject and interest he takes in it, and due to these he earns it faster and retains it longer.

7. *Feeling*: Freud and other psychologists assert that we etain pleasant experiences for a longer time whereas we forget painful experiences quickly Even if all psychologists do not accept his view of the psychoanalysts no one denies that pleasant experiences are remembered longer than painful ones. With the passage of time man becomes indifferent to all past experiences wiped out from the board of memory.

8. *Attention*: While studying a subject, if greater attention s paid to the subject the retention will be better. On the contrary, the retention will be weakened by inattention.

9 *Sleep*: Some time elapses, after study, before the subject s retained in the mind and if this time of strengthening and retenion is used for sleep, the memory traces get a good opportunity o be etched upon the memory. Psychologists differ in regard to he cause of the effect which sleep has on retention.

10 *Mental Review* · If some experience is incessantly contemplated upon its retention is better than one about which the mind does not trouble itself Really speaking, by mental review a epetition of the subject is caused which strengthens retention.

11. *Mental set*: A person retains those things for a longer period which coincide with his mental inclinations A religious person remembers idea relating to religion for a long time and a ensuous man remembers things of sexual interest.

12. *Apperception* · Apperception means the assimilating of earned subject with the knowledge already present. The retention f a newly learned subject is greatly facilitated if it is assimilated ith the present store of knowledge to start with. And on the ther hand a longer time is needed for retention if this assimilation s not effected.

13. *Intention*: This, too, is not far behind in making its resence felt, on retention If a subject is learned with the express ntention of being retained, the aim will be fulfilled with extrardinary success. But if there is no such intension, the subject emoves itself from the memory of the person after sometime. earning gathered with a view to appearing in the examinations s remembered better and things picked up here and there, in the rdinary course, are easily forgotten unless the person has a special nclination towards them.

same voice if the element of expectancy is absent. But on the other hand, mental set may cause faulty recognition because you may take every knock at the door to be the one made by the person whom you are waiting for.

2. *Confidence*: This, too, is an indispensable element in recognition. In its absence even correct recognition becomes infested with doubt and a mistake is the outcome. In reality, only trial and error can regulate the amount of self confidence which one may have in a particular situation.

Q. 75. Write an essay on how to build up a good memory.
(Madras 1966)

Ans. Many experiments were conducted, in psychology, with a view to effecting economy in memorising. In these experiments attempts were made, after experimenting with different methods of memorisation, to find that method by which the maximum material may be memorised in the shortest possible time. The economy of the following methods has been brought to light—

1. *Recitation*: The mental repetition of something is called recitation. Recitation makes the subject firmer than if it were read over and over again or repeated. Mental repetition is an active way of study. This saves time, at the same time assuming the longer retention of the subject.

2. *Spaced and Unspaced Methods*: As the name suggests, the spaced method of memorising is one in which there are time intervals in the memorisation and the subject is connected to memory after various sittings. On the contrary, the memorisation in the unspaced method is done at one sitting, without any intervals being introduced.

Many experiments were done in order to assess the economy affected by these two methods. In Ebbinghau's opinion, the spaced method is more economical in the memorisation of meaningless things. Belborn and Villian opined that the spaced method is better in the memorisation of poetry and prose. Lashley considered the spaced method to be better while Cook approved of the unspaced method.

The economy in the use of either the spaced or the unspaced methods depends upon the abilities of the individual and the nature and extent of the material. A short poem of 8 to 10 lines should be memorised at one sitting. On the other hand, it is generally difficult to memorise a poem comprising 200 lines at one sitting because the possibilities of fatigue in attempting to learn so long a poem without

rest are very great. Actually, the spaced method has many advantages over the unspaced method. Not only is the fatigue eliminated in the interval, but there is an opportunity to contemplate on the subject learnt. This helps to remove the monotony caused by long periods of study and it enables a person to keep his attention focussed on learning. The interval also eliminates any wrong activities and prevents their repetition. There is no general rule as to the interval between two sitting and it depends on the individual and the subject taught. It can be said that the interval should be long enough to remove the fatigue of the last sitting and strengthen the memory traces.

3 *Part and Whole Methods*: To study something by the part method is to divide it into parts before studying or memorising it. On the other hand, a subject is read according to the whole method when it is read from start to finish, as a whole. The experiments carried out to measure the superiority of these methods over each other have not yielded consistent results. Sometimes the part method showed better results while on other occasions it was the whole-method which excelled. Lotti Steffens concluded from his experiments on children and grown-ups who were required to study meaningless material, that the whole method saved 12 percent of time as compared to the part method. Contrary to this Pechstein, in an experiment, instructed 6 persons to learn 32 times employing the whole method, at the same time instructing 6 others to do the same by using the part method. When the results were compared, the people using the part method in the memorising had taken less time than the other six Pechstein concluded from this that the part method is more advantageous than the whole method.

Actually the two methods part and whole are not contradictory. The application of one or the other method to the memorising of certain subject is decided by its extent and nature and by the ability of the individual The whole method is better than the part method when it comes to learning a short poem but the part method proves more advantageous if the poem is a long poem. In this case, it would be advisable to go through the whole poem to start with, in order to relate the different parts of the poem and to follow this up by learning it a small piece at a time. It is generally better to use the whole method if the subject be difficult because it is easier to understand its different parts individually. But, at the same time, it is essential to use the part method in making sense out

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of the difficult portions of the subject. Thus, time can be saved in using the whole method with a short subject and the part method in the perusal of a lengthy and difficult one, but in reality, the subject will have to act according to his personal capabilities besides the general law when he wants to decide on any one particular method. If we tire easily by the whole method, the part method is unquestionably better for us.

4. *Active and Passive Methods*: Memorising by utterance is the active method while mental repetition is the passive method. Many experiments have been carried out to measure the economy which these methods may effect. Gates, Ebbinghaus and his followers concluded from their experiments that the active method is better than the passive method.

Actually the active method is better than the passive in many respects.

1. The activity in memorising is increased.

2. The desire to learn and the effort are maintained while the relation between the various parts is established easily and naturally.

3. The subject is understood and the rythmical grouping and localisation of the various parts of the material also takes place.

4. The method forms a sort of pattern of the subject in the mind of the learner and anything missing from this pattern can be recalled easily.

5. This method reduces mental distraction. But this does not mean that the passive method is always less useful than the active method. Actually, in learning any thing new it is always advisable to memorise it mentally before memorising it by reading it aloud.

5. *Rote and Intelligent Methods*: If a person is learning or memorising something without understanding it, he is said to be using the rote or unintelligent method There is no apperception in this. On the other hand, by use of the intelligent method it involves the understanding of the subject and apperception does come about.

The experiment to measure the economy of either of these subjects reveals the consistent superiority of the intelligent over the unintelligent or mechanical method. The mechanical method does not form any association between the material and the thoughts in

the mind and the matter is thus not strengthened, which results in its early elimination. On the other hand, the intelligent method lends firmness to the memory which becomes more permanent.

6. *Grouping and rythm* : Memorisation is considerably facilitated by rythm and grouping It is easier to memorise poetry than prose but by the rythm scheme. One couplet contains enough meaning to be spread over several pages, but the rythm makes the memorisation easier.

7. *Association* · Association as a factor which keeps memorisation is no less important than the other. Suppose that we have to remember that the first step in the solution of arithmetical problems is the bracket and the successive steps are of, division, multiplication, subtraction and addition and in order to facilitate it, an association between 'B' and bracket, O and of, D and division, I and into or multiplication, S and subtraction and, A and addition may be formed, keeping in mind that the letters represent the first letter of each word. These letters should now be put together to form the word BODISA; which, when remembered, will keep this law in mind Other associations in different subjects may be formed similarly.

Besides the method of memorisation detailed above, all the favourable factors in retention should be used comprehensively. The desire to memorise affords considerable assistance in remembering, because of the ease in concentration which is absolutely essential. Rest and sleep also affect memorisation and attention should be paid to them The use of similar images, similar to the subject also helps memorisation and retention

Q. 76. What are the causes of forgetting ? Briefly discuss the theory of retroactive inhibition.

(Poona 1952, Gujrat 58, Banaras 65, Nagpur 68, Muzaffarpur 64, Karnatak 65)

Ans The difficulty, or inability, of a subject in being remembered or coming to the consciousness is the mental activity, due to forgetting It contradicts remembering and it is the failure of retention. Sometimes, almost too often, the thought is retained even though it is not recalled Its inability to come to the conscious level can be attributed to a variety of reasons. Therefore, mere failure to recollect is not the same thing as forgetting. But lack of progress in relearning is definitely forgetting Briefly, failure of

recollection is partial or temporary forgetting, the failure of retention is complete or permanent forgetting.

Forgetting is a Passive Mental Process :

According to Ebbinghaus, forgetting is a passive mental process. The activity continues automatically with the passage of time and the mind does not interfere with it. The activity of forgetting proceeds with good speed for some four to six hours after the learning of meaningless pieces but by the time 5 to 7 days have passed, the enthusiasm dies out and the activity is very slow, so much so that the difference between the forgetting of the 10th and 21st days is almost impermeable.

Forgetting is an Active-Passive Process :

Some psychologists have not accepted the opinion expressed by Ebbinghaus. They think that forgetting is an active-passive process implying that the mind too takes a hand, the other being the passage of time, in forgetting. Forgetting is effected in no small measure by the mental processes which take place in the interval between remembering and forgetting. The least amount of forgetting takes place in sleep but if the person engages in some other activity it is comparatively more. Forgetting is also speeded up by some injury to the brain, consumption of alcoholic liquids, feeling, emotion, mental tension etc. In this way, forgetting is both an active and a passive process.

Causes of Forgetting

Many theories about causes of forgetting are current. Ebbinghaus attributes forgetting to passage of time while Freud and Bartlett are more inclined to blame the activities which take place in the interval of forgetting. Roughly speaking, most psychologists have given the following causes for forgetting :

1. Interpolated Activity : As far as the behaviourists are concerned, it is the interpolated activity after learning which causes forgetting, the extent of forgetting depending upon the divergence of these activities from the material learnt.

2. *Disuse* : The theory of disuse postulates that any learnt activity or accumulated knowledge will be gradually forgotten if it is not regularly practised. Psychologists who do not agree with this view assert that forgetting is due not only to disuse but also to the activities after learning.

3. *Retroactive Inhibition :* Some learning tends to contradict some previous learning, a tendency entitled retroactive inhibition, meaning the fatal effect of interpolated activity on learning. This theory was first proved by Muller and Pilzecker. Retroactive inhibition is specially affected by the following four things :

(a) *Similarity between past learning and interpolated learning :* Experiments have proved that the retroactive inhibition will increase with similarity with the past learning and interpolated activities.

(b) *Difference in quantities of post learning and interpolated learning :* Retroactive inhibition will be more if the quantities of past learning and interpolated learning are vastly different in favour of the latter. But if the latter is less, the hinderance will also be less.

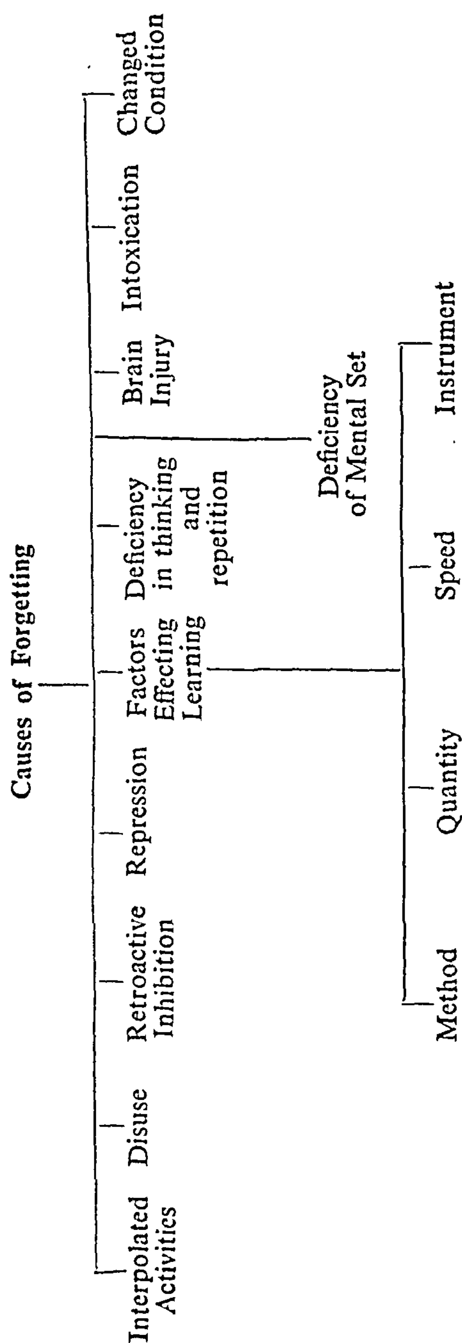
(c) *Temporal relation of the interpolated activities :* If the interpolated activities take place soon after the previous learning the hindrance will be accentuated. The most harmful intepolated activities are those which take place either immediately after learning or just before recollection while the least harmful is the one taking place in the middle of the retention period.

(d) *Intelligence and age of the learner :* Retroactive inhibition is reduced with every increase in the age and intelligence of the learner.

The two factor theory expounded by Melton and Lackun singles out two factors as having extraordinary effect on retroactive inhibition. The learning of a new thing causes the forgetting of the old by hindering its relearning and the other factor is the competition between the old and new memory traces

4. *Repression :* The psychoanalysts believe that the major cause of forgetting is repression, *i.e.*, the pushing of the experience or thoughts into the unconscious. Freud said that it is natural in human beings to repress sorrowful thoughts because of the pain of the cause if remembered. It was the theory of repression on which Freud founded his successful analysis of everyday forgetting in writting, speaking, recognising and the forgetting of the mental patients but the description of forgetting. in things other than these, cannot accept repression as the sole cause.

5. *Factors affecting learning :* All the factors which


Causes of Forgetting
Interpolated Activities
Disuse
Retroactive Inhibition
Repression
Factors Effecting Learning
Deficiency in thinking and repetition
Brain Injury
Intoxication
Changed Condition
Deficiency of Mental Set
Method
Quantity
Speed
Instrument

learning also affect forgetting because forgetting is the unlearning of a learnt subject. The major factors are—

(a) *Method of learning*: As a general rule it can be said that forgetting is less in the case of whole, spaced, active and insightful learning than in the case of part, unspaced, passive and unintelligent methods of learning.

(b) *Quantity of learning*: Within a limit, the absence of over learning may bring about forgetting, while the same effect may be produced by over learning outside the limit. Inside the limit, forgetting will be less if there is over learning.

(c) *Speed of learning*: Faster learning censures retention while slower learning is forgotten relatively quicker.

(d) *Instrument of learning*: Forgetting is more in the use of a small and less extensive instrument than in the use of a bigger and more extensive instrument. Similarly, there is more forgetting in the case of sorrowful or meaningless instruments than in the case of happy or meaningful instruments

6. *Deficiency of thinking and repetition*: Mental thinking and repetition assist retention and recollection and in the same manner these factors also affect forgetting, *i.e.*, in the absence of these factors forgetting increases.

7. *Deficiency of the Mental Set*: Mental set is another factor of assistance in the retention and recollection of a subject so that its greater concurrence will reduce forgetting.

8. *Brain Injury*: Often when a person suffers a brain injury he forgets many incidents and experience and the extent of the forgetting depends upon the seriousness of the injury.

9. *Uses of Stimulants*. Wine and other stimulants have a determental effect on the brain, because they weaken the memory traces. Thus forgetting will be increased if such intoxicants are used.

10. *Altered Stimulus condition* If there is an association between the stimulus and the situation of the stimulus, then forgetting is facilitated by any change in the situation or condition of the stimulus. People who stay abroad for long forget their correct dialect.

Besides the causes mentioned above, the factors which influence retention and recollection may also cause forgetting. In brief, every factor which hinders memorisation causes forgetting. The chart given on page 242 makes clear the causes of forgetting.

16
Association

Q. 77. Discuss the main contribution of Ebbinghaus to the growth of experimental psychology. *(Agra 1957)*

Introduction

Ebbinghaus occupies an important place in the history of modern psychology in Germany. His influence on German psychological thought is confined to the later half of the nineteenth century. He was born in 1850 in a trader's family. He was educated at the Bonn University where he studied history and physiology. For his higher education he went to Halle and Berlin. In 1870 he joined the armed forces but three years later he resigned from his commission and returned to Bonn and secured the degree of doctor of philosophy. The subject of his thesis was 'nature of the unconscious'. This led to Ebbinghaus developing an interest in psychology in pursuit of which he studied Fechner's book on the subject. After that he independently took up research work in psychology because he had no acquaintance with the contemporary psychologists and he could not invade their sanctum. He visited England and France where he picked up considerable knowledge of psychology, In 1886 he was appointed to the post of assistant professor at the Berlin University but he subsequently joined Breslau and then finally Halle University. His most important work consists of his experiments on memory.

Contribution to Psychology

Ebbinghaus' initial experiments with memory were performed upon himself, and for these experiments he invented what are called nonsense syllables. With the help of these syllables he found a solution to the problem of association. Associationists believe that association is the basis of every experience. In his examination of memory Ebbinghaus used the nonsense syllables to control the association and thereby gained control over those elements which could influence memory.

Ebbinghaus' experiment on memory can be described approximately thus. He wrote down the nonsense syllables on separate cards and then placed them in a specific order. After that he started examining them from one end. When all the cards had been seen he tried to employ his memory and write down the syllables in the order in which he had seen them. From this experiment Ebbinghaus concluded that if the number of nonsense syllables is seven then they can be memorised and reproduced correctly after one single viewing. No more than three seconds would be necessary for the purpose. In the same way if the number of nonsense syllables is 12 then they can be reproduced correctly after 17 seconds taking 82 seconds. From his experiments he gained the following data :

Number of nonsense syllables	number of recollection	time in seconds	average time, secs. per word
7	1	3	·4
10	13	52	5·2
12	17	82	6 8
16	30	196	12·0
24	44	422	17·6
36	55	792	22 0

In this way Ebbinghaus proved from his experiments that repetition and time play an important role in memory. As the number of nonsense syllables increases the number of recollections and the time also increase, a fact which is apparent from the above table.

Ebbinghaus experiments with memory in fact provided a wealth of detail. For example—examining the relation between learning and retention Ebbinghaus found out the number of recollections which would be necessary for a list of 16 nonsense syllables, which was learnt 24 hours previously, can be reproduced exactly He found that the relearning of a thing learnt 24 hours previously can lead to an economy in time of about 10%. This method of memory testing evolved by Ebbinghaus is known by the name of saving method.

Through his experiments Ebbinghaus also learnt that it is possible to calculate the time that would be needed to forget something which had been learnt Besides, what facility can be achieved if the thing learnt is relearnt or recollected at frequent intervals ? What are the best methods of memorising for longest retention ?

He also proved that the study of memory can be given a scientific basis and the facts related to it examined,

Ebbinghaus published a detailed account of his research work in two volumes, '*Theory of Colour Vision*' and '*Ground work of Psychology*'. The latter in particular achieved considerable fame and was for years treated as a standard treatise on the subject suitable for use as a text book. The style of the author was lively and attractive which was one of the reasons for the popularity of his books. Ebbinghaus occupies a premier position in German psychology, and the facts derived from experiments with memory, constitute a completely original contribution to psychology. Besides, one of the most important aspects of his work is that he proved conclusively that such elusive mental activities as memory could be studied in the laboratory, literally under the microscope, a thing which had hitherto been considered well nigh impossible. And his work is an implicit assertion of the scientific nature of psychology, an eloquent testimonial.

Q. 78. Write short note on kinds of Association.

Kinds of Association :

There are two kinds of associations—controlled association and uncontrolled association. Ordinarily, our association in different actions of our daily life is settled and therefore almost controlled. The pattern of how we shall solve problem, when it presents itself before us, is almost already settled. How little a time we took in doing so and how correctly the work was done is something important. The following two kinds of controlled associations have been accepted.

1. *Partially Controlled Association* : The process of accociation, in this, is not completely controlled. The subject selects one of the many words. In an experiment of this kind, the experimenter instructs the subject like this, "I shall speak out the name of some thing and you will speak out the name of any one part of it." Now suppose he says 'school', so many things are included in school and the subject can name any one of them.

2. *Compcteiy Controlled Association* : In this, as is clear from its name, the process of association is completely pre-settled and controlled. For example, night is the antonym for day, bad for good, white for black, big for small and high for low. Now, if any one of these words is spoken before the subject, he will certainly give its antonym.

Results of Experiments on Association :

As has been already said, the subject's knowledge about language and words is tested from the result of controlled association. On the other hand, complexes are found out through an experiment of free association. Associative reaction time is studied through the experiments of association. In this connection, experiments are made, some times by speaking a word and some times by presenting it In the same way, a subject expresses his response, sometimes by speaking, sometimes by writing and some times by naming it. Cattell, Woodworth and Wells have made many experiments about the test of reaction period through the name of an object In this, a picture of familiar objects or colours was shown to the subject and he was asked to tell their names. It was seen from these experiments that more time was taken in expressing the names of the objects than what was taken in reading them; because more practice was needed in naming the objects than what was needed in reading them Secondly, in naming an object, many names enter the mind together and time is taken in selecting the correct name from among them; while there is no need of selection in reading it In studying association reaction time about reading, Catell presented some words, letters and figures before the subject and asked him to make a response by reading them loudly and hurriedly. It was found out from these experiments that the reaction time for bigger words and figures was greater than that for smaller words and figures. It was so because more time was taken in seeing them

Besides the above methods, the study of association reaction time is also made through controlled association method In this, the subject has to speak out a word opposite or coordinating to the stimulating word In testing completely controlled association, only one opposite word is spoken and the reaction time is therefore lass In testing partially controlled association, the subject has a chance to make a selection and the reaction time is therefore greater. But then, similar conclusions are not reached about all the subjects. *In testing completely controlled association*, the reaction period of the subjects, possessing a small vocabulary, is long, because some times they donot know even the opposites. Murphy, Young, Wreschner, Cason and other psychologists have studied the reaction through a free association method. It has been found out from the experiments made by Menzorath and Wells

that reaction time can be reduced by practice, because, through practice, the subject adjusts himself to the situation and therefore does not take much time in reacting. It has been found out from the experiments made by Anderson that the reaction time in case of adults is less than that in case of children.

Through his experiments, Wreschner has reached the conclusion that the reaction period in free association is less than that in the controlled association. In 1917, a psychologist, named Mag, concluded from his experiments that the reaction time in free association is greater than that in controlled association. Nevertheless, no definite conclusion in this connection could yet be established to decide whether a difference in the controlled and free reaction period to any stimulating word is unavoidably caused or not. It has been found out from the experiments made by the psychologists, named Jhumb and Marbe, that the reaction period of a word is decreased by repeating it again and again. This fact has been verified through the experiments made by other scientists. According to Cason, a specified word, in the absence of repetition, does not remain united with the stimulating word and the reaction period is therefore increased. Thus, the reaction period is reduced by repetition.

Determinants of associative reaction period—

Associative reaction period depends on various factors. Many experiments have been made about the effect of these factors. In a concrete form, the factors effecting the associative reaction period are given below :

(1) *Indirect Response*—Indirect response is that which the subject does not express but keeps it hidden in his brain and presents some other word instead to represent response. In this way, in case of indirect response, the associative reaction period is increased.

(2) *Interfering Response Words*—In order to associate some words, many words often present themselves before the subject and time is taken in making a selection among them. So, in the presence of such interfering response word, association reaction period is increased.

3. *Internal Distraction*—Sometimes, the attention of the subject is internally distracted by a stimulating word on the recollection of some happy or sad event. It is clear that it will cause some

delay in making response and the association reaction time will increase.

4. *Absence of Response word*—Sometimes it so happens that, on presentation of some word, no other word or idea in the form of response enters the mind of the subject immediately, and a delay is therefore caused in making response and the association reaction period is increased.

5. *Mental Condition*—The effect of mental condition on the associative reaction period is important. If the subject is mentally alert, he makes the response at once and the associative reaction period is less On the other hand, if the subject is not mentally alert, the response is delayed and the associative reaction period is more. Besides the mental alertness, complexes, relation between stimulating and responding words and many other mental factors affect the associative reaction period.

Free Association :

Association is not fixed and controlled in fr e association. The results of free association, in a concrete form, have been used with two kinds of purposes

1. *Detective*—Free association method has been used in many countries to detect a crime In this method, a list of at least twenty stimulating words, which are related to the circumstances of the crime, is made Now, besides these, some eighty such words are selected, which have no special relation with the circumstances of the crime. The list of these hundred words is presented before the accused and he is instructed to express the first word that enters his mind atonce after the stimulating word is spoken Now, the stimulating words are spoken, one after the other gradually, and it is found out with the help of stop-watch as to how much time does the accused take in responding the various words Along with this examination, the gestures of the accused in making response are also taken into account Blood pressure is also sometimes taken. The first psychologist to detect crime through this method was a German psychologist, named Wertheimer After that, many other psychologists have successfully used this method The psychological principle at the root of this success is that, when such stimulating words, which are connected with the criminal incident, are presented before the accused, the accused tries to repress the response which presents itself in his mind and this increases his reaction period to those words. Now, if some accused takes more time in response to

most of the twenty specified words given in the list, there is sufficient ground to believe that he has committed the crime, or else he would not have behaved like that. Here it is necessary to note how much time more an accused has taken in making response to the words relating to the incident. This fact can be ascertained by comparing his reaction time with the reaction time of other accused persons. Now, if the accused person is only one, it will not be proper to consider him as guilty or guiltless only on the grounds of his reaction time, because it cannot be decided whether his reaction time in case of those specified words is more than the time normally taken or not. Therefore, a crime can be detected through free association test only when this test is given to more than one accused persons. It is clear that a great care is necessary in detecting a crime through this method.

(2) *Diagnostic*—It has already been said that the response words are closely related to the mental feelings and emotions of a person. Mental physicians, therefore, use this method in finding out internal complexes of the mental patients. First of all, the psychologists, named Jung and Riklin, used this method in diagnostic experiments. This method has special importance in diagnostic process, because the mental patients themselves do not know their own complexes and they cannot tell anything, if they are directly asked about them. In making response to stimulating words, a mental patient unknowingly expresses his mental responses to different objects. It is clear that, for diagnostic purpose, the list of stimulating words should be such as to include words relating to the important aspects of the patient's life. After a list of words relating to the patient's profession, his married life and family etc. is prepared, the patient is asked to sit in a separate room. Here the experimenter presents before the patients all the words, one by one, and instructs him to express his response to every word immediately and without any hesitation. After once obtaining responses to all the words in this way, the list is again presented before the patient. The subject is instructed to make, from his memory, the same responses which he had made on the previous occasion. Such responses are often different and, in that case, the experimenter takes note of them. Many things, such as mistaking the stimulating word to be some other word, giving an irrelevant response, showing surprise, laughing, smiling, stammering, growing pale, inability to remember the individual response or the first response etc. are seen, in the responses made by the patient to the stimulating words,

closely related to his mental condition. The words, to which such specified responses are seen, are taken to be connected with the mental complexes of the patient. Mental complexes have been found out in this way in many patients on the basis of a free association test. It is necessary in this experiment that the subject should give full cooperation to the experimenter and that there should be no obstruction of any kind in the association at the time of experiment. No correct conclusion can, otherwise, be reached, from the results of the experiments. In brief, if a proper use is made of a free association test it is found to prove helpful in diagnosing the complexes of the mental patients.

Q. 79. Write short note on—Constrained Association *(Agra 1963)*

Or

What is controlled association? Describe an appropriate experiment to study controlled association. *(Gorakhpur 1961)*

Or

Write short note on—Free Association. *(Agra 1952, 1960)*

Constrained Association Experiment :

It is a matter of common experience that different ideas get mixed together in the mind due to various reasons. This process is called association. There are two kinds of association—Free and Constrained. In a free association, there is no impediment of any kind in the process of association and it works quite freely. In constrained association, on the other hand, there are impediments in the process of association as its very name signifies. In this kind of experiment, the experimenter limits the association area of the subject. The subject can have the same association with the stimulating words as has been fixed by the experimenter.

There are two *forms of constrained association—partial* constraint and full constraint. In the partial constraint, as is clear from its name, the process of association is partially fixed. In this, the subject can select some reactions within a fixed limited area. On the other hand, in the condition of full constraint the reaction of the subject is fixed before hand.

The main kinds of partial constrained association are given below :

1. Coordinates : In this, the names of the objects, similar to the given word, have to be told. For example, if the stimulating word is plant, the name of the plant has to be given if it is an

animal, the name of the animal has to be given and so on in case of other things, such as mango, jamboo, pigeon, crow, cow and a buffalo etc.

2. *Sub-ordinate Superordinate relation*: In this, there is a sub-ordinate superordinate relation between the given names and the words spoken through association. For example, the book is made of paper, and therefore there is a sub-ordinate superordinate relation between them. Similar examples can be of house and bricks or the machine and its parts etc.

3. *Species-Genus*: In this, when the name of some group is given, the name of its kind has to be spoken: and if the name of the kind is given, the name of the group is spoken, such as animal-monkey, fruit—apple etc. and Ram—man, rose—flower etc.

The kinds of complete constrained association are given below :

1. *Opposites*: In this, the subject has to tell the antonym of a stimulating word, such as small-big, light-heavy, fair-black, fat-thin etc.

2. *Analogous*: As is clear from its name, the subject has to present, in this, the words analogous to the stimulating words. For example: if the exprimenter says "coal : black", it has to be seen in this that a word, which has the same relation with stimulating word, as black colour has with coal, should be given in the form of reaction, just as 'black' will be spoken after 'coal' and white after 'milk'. In this, the experimenter first speaks two words and then presents the third stimulating word and the subject in reaction presents the fourth word which has the same relation with the third word which the second word has with the first.

Some of its examples are given below :

Japan : Japanese.	India : (Indian)
Moon : Night.	Sun : (Day)
Three : Four.	Five : (Six).

The above examples can also be given about species-genus, figure sequence etc. For example, a problem can be presented like this—If Mohan is fatter than Sohan and Rama is fatter than Mohan, who is the fattest of the three ? Or, Sita was the wife of Rama and Laxman was Rama's brother, how was Sita related to Laxman ? Etc.

First of all, Galton, in the 19th century, conducted experiments about association. The first experiments about constrained

association were conducted in the laboratory of Wundt in Germany. Experiments by Cattell are regarded as authentic even now. After that, Brayant and Kent threw light on the problem of constrained association.

Experiment :

Date......Day......Time. ....Place......Environment......Name of the subject .. . Age of the subject......Mental condition of the subject...... .

Problem—Study of the subject's reaction to the stimulating *words in partial and fully constrained condition.*

Instruments and Apparatus—(Five) lists of stimulating words, stop watch, wooden screen, paper, pen and pencil.

Method of Experiment :

To conduct this experiment, the experimenter should first prepare five lists of stimulating words. Each list will contain twenty words. The first two or three words of these, will be for practice, so that the subject may know from them as to what he has to do. Out of these five lists, there shall be two lists of partial constraint, two of complete constraint and one list of free association. One list out of the two lists of partial constraint will include the association words of coordinates and the other *will contain the association words of species-genus Out of the two* lists of completely constrained association, one list will contain the words of opposite association and the other will contain the words of analogous association Along with these five lists, proforma to note the reaction word and time will also be prepared.

Before starting the experiment, the experimenter will wind and examine the stop-watch. He will then ask the subject to sit in an arm chair before him and will place the wooden screen between himself and the subject in such a way that all the instruments and apparatus such as stop-watch, paper, pencil, lists etc will remain behind the screen and the experimenter will be able to see the subject plainly

Instructions—Now the experimenter instructs the subject about the association. Before beginning each list, instructions, suited to the same, are given. For example, separate instructions, to be gradually given for different five lists, mentioned above, a noted on next page

Partially constrained, association list :

(*a*) *Co-ordinater*—"Now some words will be spoken before you, one by one. Atonce after hearing one word, you have to speak out hurriedly the word that enters your mind in a way of reaction, such as pen-inkpot, paper-pencil etc.

(*b*) *Species-Genus*—"Now some words will be spoken before you, one by one. As soon as you hear a word, you have to tell the genus, if it is speci es; and you have to tell the species, if it is genus, such a s men—Mohan, fruit—apple, Sita—girl, cow—animal etc."

(2) **Completely constrained association :**

(*a*) *Opposites*—"Now some words will be spoken before you, one by one. You have to speak its opposite word in way of reaction, such as black-white, small-big, fat-thin etc."

(*b*) *Analogous*—"Now some problems will be presented before you, one by one. The first two words of each problem will have special relation. You have to make out that relation. Now the third word will be spoken and in reaction to it, you have to speak such analogous word which should have the same relation with the third word which the second has with the first word, such as black crow, white swan, three-four and six-eight etc."

In the above examples, black is the colour of the crow. Whose colour is white ? The word 'swan' will be spoken in answer to this question. Similarly, three is half of six. Whose half the four will be ? Eight will be spoken in answer to it. In both the examples, the relation, which exists between the first two words, is also seen between the third and the fourth.

(3) **Free Association :**

"Now, some words will be spoken before you, one by one. On hearing each word, the word which strikes your mind in the beginning in the form of reaction should atonce be spoken by you hurriedly without the least attempt to hide it."

Process of experiment—When the arrangement of the experiment is complete, all the five association lists are presented, one after the other. Before starting the first list, suitable instruction is given to the subject and it is ascertained that he has understood the instruction. Now, as soon as a word from the list is spoken, the stop-watch is made to work ; and when the subject's reaction to it is received, the watch is stopped. The reaction word and the reaction time is noted against the stimulating word in the proforma

attached to the list. The first two words for practice and the next 20 words for actual experiment are given in the list. When the whole list is finished, an introspective report is taken from the subject about his association reactions. In this report, the subject describes his experiences about the nature of the difficulty that he came across in some association and about the problem, emotion and his own individual feelings. The mental process of the subject is known from this. Thrs introspective report is also added to the proforma. The subject is allowed some rest after presentation of a list. If the experimenter and the subject are fellow-students, they often change places between them. In this way, the reactions of association about all the five lists, one by one, are obtained. The experiment being long, there is generally a possibility of the subject getting tired. This experiment is therefore completed in two sittings in two days. On the first day, three lists are presented and, on the next day, the remaining two lists are presented. All the afforesaid five lists should be presented in such sequence that every list should have a greater quantity of constraint than its previous list. There is no constraint in the list of free association and it is therefore presented first. After this the lists of partial constraint and, last of all, the lists of complete constraint are taken for experiment. Among the lists of partial constraint, the lists of coordinate associations are taken first and the lists of species, genus, associations are presented next In the list of complet constraint, toe list of opposite association are presented first and the lists of analogous association are presented next

Precautions—Attention is paid to the following precautions in conducting this experiment

1. In every list, there should be atleast two words for practice and then twenty words for experiment

2. After the completion of each list, the subject should be allowed some rest before starting the next list and the experimenter and the subject, if they are fellow students, should change places between them.

(3) As soon as each list is finished, the subject should be asked to submit introspective report and an attempt should be made to understand his mental process through it.

(4) Before presenting each list, instructions should be given in clear words and with examples It should be ascertained from the subject that he has followed the instructions quite well.

5. The environment at the time of making experiments should always be very peaceful or else there is a possibility of an obstruction creeping in the association process of the subject.

Results—In this experiment, quantitative and qualitative results are drawn on the basis of received in the following way :

(a) Quantitative Results.

1. To find out the average reaction period of every list separately—From this the figures in the column of the reaction period of each proforma are added and divided by the number of words in that proforma. For example, if the total of seconds in the column of reaction period is 50 and the number of words is 20, then 50 is divided by 20 and the average reaction period will be 2'5 seconds.

2. The average reaction period of the partial and completely constrained association is taken out separately and compared with the reaction period of free association.

3. The average reaction period of every subject is compared with the average reaction period of other persons of the group.

(b) Qualitative Results—

To find out the qualitative result of the data, the following things are noted in their reactions of partial and complete associations.

1. The occasions when the subject has given wrong reactions.
2 The occasions when the subject has not reacted at all.
3. The reaction period which is too long.

The causes of the above three things are examined on the basis of the introspective report. Any other thing which is found out from this report, besides the above things, should also be noted.

Explanation—Attention is paid to the following things in explaining the data.

1. Why and in what condition was the average reaction period long ? The average reaction period in free association is generally the shortest, it is longer in partially constrained association and it is longest in completely constrained association. If the result in case of some subject is different from this, the cause of difference should be examined.

2. Individual differences also have their effect on the average reaction period. In the given experiment, the effect is shown by comparing the subject with other individuals of the group.

3. It should be shown from the explanation of the qualitative results of a subject that the greater is the knowledge of words of an individual, the shorter will be his reaction period, because he does not take much time in selecting the words. On the other hand, the smaller is the vocabulary of an individual, the longer will be his reaction period and greater will be the number of his failures.

4. The mental actions such as perception, memory and thinking etc. also affect the reaction of association. If these mental actions are of a high standard, the very form of association undergoes a change But it needs a long time to examine the effects of all these factors and therefore they are not to be examined in the present experiment.

5 Mind also has an important effect on association. The mental range of the subject in the present experiment can be examined and its effect on association can be shown.

6 If the mental condition of an individual has affected association, it should also be shown clearly.

Conclusion—The following conclusions about the reaction of constrained association are reached through the present experiment.

1. Along with increase in constraint and a resultant limitation of the field of selection, the reaction period goes on increasing. The reaction period, therefore, is the shortest in free association, a little longer in partially constrained association and it is the longest in completely constrained association

2. Difficulties are, more or less, seen in various kinds of association. For example, in the process of association, the difficulty in free association is the least, it is greater in a partial constraint and it is the greatest in complete constraint association. Even in partially constrained association, the difficulty in co-ordinates is less than that in other kinds. In completely constrained association, the difficulty in opposites is less than that in analogous. Along with an increase in difficulties, the reaction period also goes on increasing.

(3) Mind, vocabulary and individual differences also affect the constrained association

4. Due to the effect of the process of constrained association on the process of thinking, the laws of thinking, formulated by spearman, can be proved on the basis of this experiment.

Practical advantages :

1. Experience and its association have an important effect on our daily thinking.

2. The mind, thinking, emotions and complexes of an individual can be found out from this experiment.

3. This experiment throws light on the form of reaction period and also on the factors affacting it.

17
Imagery

Q. 80. Describe different methods of studying Imagery.

In studying imagery, psychologists have approved the following methods

1 *Learning method*—It is a matter of common experience that imageries are helpful in learning Different kinds of imageries *work in different kinds of learning. Imageries of the words* spoken before us are often presented in our brains on hearing them The kinds of imageries, which are strong in an individual, *help him in learning the* same kinds of words *easily* and quickly. In the method of learning, some such fixed words, as are related to various imageries, are presented before the subject. The kind of imagery, which help the subject in learning the word, related to it, easily and quickly, has to be discovered. The kinds of imageries, which are numerous among them, are discovered from this But there is one difficulty here. *It is* true that, if the word, which presents a particular kind of imageries in a particular subject, is discovered, the abundance of imageries can be found out from the ease with which the words are learnt But the word and the kind of imageries it presents in the brain of a particulir subject cannot be know *definitely. This method, therefore, cannot be said to be* satisfactory.

2 *Distraction method*—In this method, the subject is engaged in some work and then a distruction is related in *his* work *through* various kinds of stimuli. Now, the subject is believed to have, in abundance, the same kind of imageries as the kind of distraction which creates a great obstruction in his work There is one difficulty here *It is* this that, generally, *some particular kinds of distractions affect all the subjects more in* comparison with other *kinds of distractions. For example, the* works done with the help of the eyes are more affected by a distraction of the ears, and similarly, works done with the help of the ears are more affected by a distraction of the eyes Thus, distraction

depends on the kind of work also. The imageries, therefore, cannot correctly be studied through the distraction method.

3. *Association method*—In this, the subject is instructed to write, for five to seven minutes, the names of some objects related to every kind of imagery. The imagery of the subject is found out from the names of the objects he writes. The subject is believed to possess, in abundance, the kinds of imageries similar to the words which are numerous The chief defect in this metod is that, to interpret, from the utterance or retention of a certain word, that an imagery related to it is also present in the brain of the subject, would be wrong. For example, when he says 'flute', it is not necessary that an imagery of the flute is also there in his brain, sometimes it so happens that the retention of some object, event or experience is possible without considering its qualities. In such a condition, to accept the presence of an imagery, similar to a word, would not be proper.

4. *Method of writing analysis*—In this method, as is clear from its name, the mental imageries of a subject are discovered from the analysis of his writing. This method is based on the common experience that the mental imagery of the topic, object or scenery, that an individual describes, is present in his brain at the time of writing it. Therefore, the imageries related to the objects, about which he writes more can be believed to be in abundance in his brain. But this fact is not applicable to all the individuals. Some such examples are available, where in the writer could describe some objects related to some special kind of imageries, even in the absolute absence of those imageries. Had it not been so, how some poets, blind from their birth, could give so beautiful descriptions of various topics? It is therefore, baseless to imagine the presence of some special kinds of imageries in an individual on seeing his writing.

5. *Picture description method* In this method, a particular picture is shown to the subject for some-time and then he is asked to write a detailed description of the same. After the writing is finished, many questions about the picture are put to the subject and the answers are taken down. It is believed that the subject. in order to describe the picture, needs verbal and visual imageries, Therefore, the better is the description of the picture, the better will be the imageries of the subject. Fernold, Mullar, Binet and many other psychologists made use of the letter squares in the

picture description method. Picture description method will not be considered satisfactory through psychological point of view, because to imagine the mental imageries of the describer from his description of the picture is not reasonable

(6) **Questionnaire method**—In this method, some questions about the various forms of imageries are put to the subject, in answer to which he gives a description of his imageries He tells, through introspection, whether the imagery is clear or dim. An average is taken by evaluating the description of this manifestation. Now, the greater is the average evaluation of an imagery, the stronger will the imageries of that kind in the subject be regarded. Correct conclusions, to a great extent, can be drawn about the imageries by using the questionnaire method properly. But, some precautions should be taken in this connection. For example, the number of questions relating to every imagery should be equal. Secondly, the questions should be distinct and simple The questions should be about such imageries that there may not be any difficulty in experimenting them. The questions should be direct and small Inspite of all these precautions, the conclusions drawn through this method can be sometimes wrong, because an individual difference is found about the imageries.

It is clear from the above description of the various methods studying imagery that the questionnaire method is considered to be the best among them.

The methods of studying Imagination—Psychologists have made use of the following main methods to carry out experimental study of imagination

(1) **Ink blot test**—First of all, Binet and Henry made use of this test to examine the fertility of imagination After that, Whipple made use of 20 ink blot cards The following two methods are employed in testing the fertility of imagination through ink blot tests.

(a) The subject is allowed to see any one of the ink blots. He goes on noting down the imaginations which arise in his mind on seeing a blot All the ink blot cards are presented, one after the other. The fertility of subjects imagination is found out with the help of the time taken in presentation of the cards and the imagination that arose on seeing them

(b) All the ink blot cards are placed up side down, before the subject. Now, he is instructed to pick them up, on

and to express the imaginations, which enter his mind, one by one, The time taken in this act is noted. When all the cards are dealt with, attention is paid to the time taken in one imagination. The fertility of the subjects imagination is found out all the more distinctly through this method, because the greater is the fertility of imagination in an individual, the greater will be the number of objects imagined. On the other hand, the less is the power of imagination in an individual, the less will be the number of objects seen in ink blots.

2. *Word Building method*—The constructive aspect of imagination is found out through this method of studying imagination. In this, the subject is asked to make as many words as possible, of six letters each, within five minutes, with the condition that no letter should be used more than once in one word. The constructive imagination of the subject is found out from the number of words successfully built in this way, wi.hin five minutes.

3. *Completion testing method*—There is yet another method, known as completion testing method, to study the constructivity of imagination. Ebbinghaus used it, first of all. In this, the subject is given a form in which there are many places left out blank. The subject is instructed to fill up these blanks. The constructive aspect of his imagination is found out from this. The difficulty in this is that it is the mind which is used here more than the imagination. Correct conclusions, therefore, cannot be drawn through this method. Some pychologists ask the subject to write a story with the help of some words. This method of testing the constructive ability has been proved to be more useful than the method of Ebbinghaus.

4. *Binet method*—The psychologist, Alfred Binet has presented another method similar to the method of Ebbinghaus to test imagination. In this the subject is given the first portions of a sentence and he is asked to complete the sentence. This throws light on the various aspects of a person's imagination. Constructivity in imagination is found out from a sentence made beautifully.

5. *Maskelyne method*—The psychologist, Maskelyne, has also presented a method of testing the constructive ability of imagination. In this, the subject was instructed to make as many sentences as he could with the help of some words within five minutes. These words included nouns and verbs. An estimate of the

constructive ability of the subject's imagination could be had from the sentences he made. A great defect in this method is that, in doing this act, mind is employed more than imagination.

Fertility of imagination and constructive ability is found out through the aforesaid methods of studying imagination. In fact, imagination is needed in constructive acts of any kind ; and therefore the greater is the number of constructive acts that a person does, the greater is the imaginative power which that person is supposed to possess In the same way, the most important among the kinds of imageries included in the imagination of a particular individual can be found out through the kind of constructive acts and the mediums like poetry and painting etc. Experiments are still being made in this connection to explore better methods of studying imageries and imagination in future.

18
Thinking

Q. 81. What is thinking ? Analyse the process of thinking in solving a problem with the help of a suitable example.

(*Banaras 65 ; Muzaffarpur 1965, 64*)

Thinking in the mental solution of problems :

Thinking, which is complex mental activity, cannot be easily separated from learning, memorising, imagining etc. As Warren puts it, "Thinking is an activity concerning idea. It is symbolic in character, initiated by a problem or task which the individual is facing, involving some trial and errors but under the directing influence of that problem and ultimately leading to a conclusion or solution of the problem." Thus, the activity of thinking originates from some problem, and is the response of the individual to this problem. The solution of the problem takes place internally and not in the form of external activities. Thinking starts with a problem and concludes with its solution. This activity of thinking continues till either the solution is found or till the person becomes fatigued by the effort. There cannot be any thinking in the absence of some problem. Problems in human life come in an incessant stream and they have to be solved by thinking. No general rule can be laid down as to the circumstances which create problems. The reactions of the same individual to different situations and of different individuals to the same situations are not identical or even similar. One situation may appear problematic to one person while a number of other persons may find nothing of the nature of a problem in it. The problems of different persons like philosophers, scientists, and religious minded persons are dissimilar. The problems of a logician appear meaningless to the uninitiated but the logician is immersed day and night, in a search for their solutions. Some problems are theoretical while others are practical. The problems of study in B.A. are practical but the problems of the logician are theoretical. The solution of practical problems assists day to day life while the solutions of theoretical problems lead to the satisfaction of curiosity.

Forms of thinking :

Thinking, the mental solution of problems, *makes use of the* symbols of objects instead of the objects. Thinking attempts the solution of problems by employing the trial and error method. There is a kind of flow in the activity of thinking, one problem leading to the thinking of another by reminding the person of that other problem. Thus many things come to the thinker's mind when he is thinking. The instruments of thinking—images, imagination, signs, indications, and such-like are also internal. Thinking continues to be an internal activity unless and until it takes the form of verbal thinking.

Thinking is symbolic behaviour :

The aim of purposeful thinking may be discovery, but it may equally well be invention. When there is a problem, either a solution to it is found or, instead, some new idea is found. The inventions make use of both analysis and synthesis. There is foresight in thinking because the remotest possibilities of the future are thought of in advance Hind sight is also an element of thinking because it makes use of material collected from past experiences. Thinking is done with the help of abstract signs of real objects, which adds to thinking the element of abstraction The major form of thinking is reasoning, which works on the basis of trial and error It economises time and energy because of mental research instead of motor exploration

Instruments of Thinking .

Thinking calls for the assistance of percepts, images, concepts, signs and formulae, of which it makes abundant use. These are the essential instruments of thinking

1 **Perceptions** Percepts are important factors in thinking, affording material to it They also stimulate thinking Suppose we have seen our friend doing something This perception will set us thinking in order to discover ways and means of preventing our friend from this bad act Many other percepts will assist in this thinking. We will, with the help of memory, try to recall the perceptions of the past behaviour of our friend in order to see the causes which may have set him on this wrong path of life in the hope of discovering ways and means which may be expected to cure him.

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2. Image : Image, too, is a kind of symbol which includes the faint recollection of perceptions. Past experiences of an individual move around in his mind in the form of images. Images may be recalled through a conscious effort but they also flash on the mind involuntarily. Many experiments have indicated that images are not quite as essential to thinking as they were previously considered to be. The use of images in thinking depends in no small measure upon the method of thinking which the individual employs. Some people use other symbols in their thinking, instead of images. It is not essential that a singer must have auditory images in order to be good. Thinking in philosophy and political science makes better use of words than images. Similarly, subjects like arithmetic make very infrequent use of images. Sometimes a person experiences difficulty in making the other person comprehend his thoughts just because they differ in their ways of thinking.

3. Concept : Concepts are the abstract forms of past experiences. Humanity is the quality of the human species, found equally in all human beings. A concept is a general idea and, as the example makes clear, it is founded upon perception. The concept of humanity cannot be formed without the perception of human beings, because humanity is the common element in the perception of human beings. An abstraction of humanity from human beings is necessary in order to proceed from perception to concept. Concept, formed with the help of abstraction, is mental. Concepts extend the limits of thinking to include both the past and the future. Reasoning cannot be done without concepts, which are both abstract and general. These are the indispensible elements of thinking. Classification of objects is done on the basis of concepts. While it differentiates between different classes of objects and creatures, it also shows the similarity between individuals of the same class. Conceptual thinking takes less time because it facilitates the thinking of innumerable things by a few concepts. Thus one concept is the symbol of many objects. But all concepts are not equally extensive. For example creature is more comprehensive than human beings which in its turn, is more comprehensive than Indians. Indians are included in human beings who are included in creatures.

4. Symbols : Concepts are made use of in thinking mainly with the help of symbols, which are the representatives of general thoughts. Whenever our thoughts turn to human beings, the

human figure, which occupies our mind is a general figure, not that of any specific person. The image of a dog is a symbol of dogs in general One or its numeral equivalents are symbols of unity while two or 2 symbolises dualism. The sound of a whistle may be the symbol of a policeman or a watchman. The noise of the fire engine is the symbol of fire. Thus the use of symbols in thinking saves time and energy.

Symbols and Signs

Symbols and signs are intimately related. Symbols change to signs. In daily behaviour symbols are used extensively in the form of signs. The whistle of the watchman is a sign of his presence, and the green flag is a sign of the departure of the train. Arithmetic makes extensive use of signs e g + indicates addition, −subtraction, × multiplication Similarly a^2 means $a \times a$. The use of symbols as signs simplifies thinking even further. There is some difficulty in establishing the symbol of the concept and the sign for the symbols in the beginning but once this difficulty is overcome the activity of thinking proceeds at a greater speed. Once we get used to them, we make use of these symbols without any conscious thought about their meaning or representation. The learning of a language presents an initial difficulty in the recognition of letters, but their subsequent use in understanding the meanings and in thinking is greatly facilitated. Though the understanding of signs in algebra takes some time, problems can easily be solved after wards. The facility in the use of language in thinking is due to the use of symbols. The letters are symbols in language, but in other languages pictures serve the same purpose Some languages replace symbols by signs.

5 **Formulae :** Besides the symbols and signs, the use of formulae also results in the economy of time and energy. One small formula contains a world of meaning Comprehensive use of formulae is made in arithmetic and science In Geometry, for example, the formula πr^2 represents the relation between the radius and the circle. The compound 'water' is represented by H_2O, which means that two atoms of hydrogen and one of oxygen combine to form water.

Thus, thinking makes very extensive use of percepts, images, concepts, symbols and formulae Among them, concepts, symbols and formulae indicate the importance of language in thinking.

Q. 82. Deal briefly with the studies on thought processes by the Wurzburg school. *(Agra 1957)*

Wurzburg movement is among the famous movements of the twentieth century in modern psychology. It was the father of gestalt psychology started by Werthemer in 1912. This movement was started by Brenteno. Brenteno created a psychology in which more importance was given to action than to experience. Brenteno differentiated between the core of experience and the process of experience. Instead of differentiating between experience and the action of recognising it Brenteno differentiated between the structural and functional forms of experience, For example, difference between red colour and its sensation can be seen. According to Brenteno the subject matter of psychology is the action of experiencing red and not red colour. In this way, psychology studies that action which occurs in the mind at the time when an experience of red colour takes place. This experience is dynamic whereas red colour is a passive matter. According to Brenteno the core of the mind points out towards an object outside the mind.

Mach—The second psychologist to make important contribution to the Wurzburg Movement was Mach. He was a structuralist. According to Mach there is no difference between the subject matter of physics and psychology. But in psychology attention has to be given to certain sensations which are not in the physical things but exist in the relationships between them. If we see three different spots and react towards each of them, then something in addition to these blots arises in our experience. This is their spatial relation and just as we feel the dots differently, similarly we also feel this spatial relation. In fact this spatial relation can be seen by introspection in the same way as any other fact. In order to examine this, arrange the same spots at that place but in a different pattern and then see that we have different spatial sensations. In this way Mach found the traditional categories of sensory experience to be insufficient. His form of thinking was structuralist.

Von Ehrenfels—After Mach, Von Ehrenfels presented important psychological principles in Germany. He was the founder of the famous school *Gestalt qualitat'*. The meaning of this word is 'The quality conferred by a pattern'. It is clear that according to this school in every perception some qualities are seen which are in addition to the sensations gained from the various senses. These qualities are the qualities of the form, the structure or the pattern of the object perceived. This principle is different from

Wundt's theory of 'Creative Synthesis'. In creative synthesis synthesis of elements has been accepted. On the other side according to Von Ehrenfels in every perception the form of the object is a distinct quality. For example in any sweet music the sound of different musical instruments which have created the music cannot be recognised This is because all these sounds combine to form such a pattern the sound of which is different from the various individual sounds of the instruments. Here it must be noted that as yet nothing had been proved in the Wurzburg school by the experimental method.

Kulpe—The work was done by Kulpe for the first time. He was the chairman of an experimental laboratory in Wurzburg. He found out some elements by experimental analysis. For example he analysed the factors responsible for self-determinant actions. Kulpe's work started in the early stages of the 20th century. His laboratory at Wurzburg became a centre for research where experiments were performed on many such problems which were neglected by the school of Wundt.

Marbe—In this first comes the study of Marbe. In this the subject was kept in a situation in which he had to arrive at a decision, and provide also a respect on the actions taking place between excitement and decision on the basis of Introspection. The problem of decision was, for example, to distinguish the heavier of any two things This judgement could be done in the form of words or any external action which the person performing the experiment could give in this study towards the mental processes which occur before the decision

Watt and Messer—After the study of Marbe, Watt and Messer found out a method by experimenting association by which the thought processes between the utterance of a word and reaction towards it could be found, It was found by these experiments that many elements were found by introspection which cannot be included in the description of sensory experience These experiences were quite similar to the stream of consciousness decribed by James In other words, experience seems *like a flow and like a collection of* disintegrated parts These can also be called conscious tendencies These are nuclear and indefinite and these cannot be changed into simple sensations, images or feelings. These experiences are quite similar to Stout's imageless thoughts The conscious feelings of doubt and determination, acceptance and refusal, are included

Watt pointed towards actions which influence the action of decision and thought though they are not present in the conscious mind.

Ach—In addition to the above problems Ach analysed the process by which a man reaches decision. He saw that before any decision, conscious feelings are accompained by inclinations which although beyond consciousness, influence the thought process and thus the decision. By this analysis Ach classified the men into "decisive kinds" on the basis of Introspection. Ach's research supports the views of Kulpe. By this Watt's study is also verified. Ach has called these elements, which are important in the process of decision, the decisive tendencies. These elements have a close relation with meaning. Ach said that consciousness of meaning is completely managed and directed by the unconscious tools. If there is any meaning of an object in consciousness, then the reason for it is those ideas which have been excited in the unconscious. In this way meaning does not depend on concious elements. It depends on the excitation of the associated ideas. Ach also attracted attention towards consciousness.

Karl Buhler—In 1907 a new era started in the Wurzburg school due to the findings of Buhler. At this period in America Woodworth was doing research work on the process of thought. In France, Binet was independently experimenting on the process of thought. In his experiments on thought process Woodworth stressed the reality of thoughts and feelings of relationship. According to Woodworth the definition of feeling cannot be given in structural words. In the process of thought Woodworth stressed, like Ach, two different forms of meaningful consciousness. Buhler conducted research by the method used by Woodworth and with a similar purpose. Buhler particularly paid attention to reality of sensational thought processes. Till then, no attention had been paid to this in the Wurzburg School In the experiments of Buhler a long interval of 5 to 20 seconds was given between problems and their solutions. This increased the possibility of error introspection. Hence Wundt challenged its experimental validity. In this way a clear opposition occurred between Wundt and the Wurzburg school. Buhler proved the existence of such elements in feeling which were not sensational. Before this psychologists had seen relations only in the form of relations, but Buhler accepted them to be new structural elements, elements of thought. In this way he proved the relation between conscious elements of introspection. In the process of thought it is an important part of the content.

Wundt's Criticism

As has been mentioned earlier the Wurzburg school had to become the prey of Wundt's criticism. On the other side in America Titchener did not accept the experimental conclusions of the Wurzburg school and ignored them. Wundt was greatly respected in Germany. He had long experience of experimenting with the introspection method. Hence his criticisms had great effect on the experimenters of the Wurzburg school and they tried to safeguard their theories. According to Wundt the Wurzburg research related to the tendencies which determine thought current. Wundt praised their work in this sphere But on the other side he criticized the Wurzburg School for presenting many such experiments and ideas which could never become a part of organised psychology.

Titchener's Criticism

Titchener of America, who was a structural psychologist only accepted sensations, images and feeling as elements of consciousness. He refused to accept the concept of imageless thought. He defined the experimental elements of Buhler and conscious tendencies of Watt in terms of structuralism According to Titchener the so called conscious tendencies are a complex organisation of sensations originating in the sense organs. To accept them as extrasensory was due to the wrong use of the introspection method As far as the question of meaning goes according to Titchener they came under the sphere of logic and not under that of psychology. Therefore the Wurzburg research related to meaning cannot be included in psychology.

Search for Experimental Proofs

By the lectures and experiments of Titchener the difference between him and the Wurzburg School became clear. The experimenters of Wurzburg School concluded from the objections of Titchener that they had given sufficient experimental proof of their conclusions. Therefore, they engaged, themselves *in collecting sufficient experimental proof for the given mental conditions* They experimented to safeguard their fundamental theories One of this kind of effort was T. V Moore's experiment regarding the relation of meaning and Image. Moore concluded from this experiment that meaning and image were two different psychological elements Hence contrary to Titchener's principle Moore accepted a fourth independent element other than sensation, image and meaning To prove the

presence of meaning Moore performed some experiments. He gave a list of some words to 9 persons to read and hear. He gave instruction in compiling this list that as soon as the meaning of the word become clear, at once the subject was to lift up his hand from a telegraph key. In the second experiment he gave instruction that as soon as an image appeared in reaction to a word the subject was to lift his hand from the telegraph key. It was seen in these experiments that except for one person, meaning invariably appeared earlier than image, in the case of all eight subjects Whereas it takes half a second for the appearance of a meaning it takes, on an average, twice the time for the appearance of an image. By this experiment Moore criticized Titchener's contention that there were only three elements in consciousness—sensation, image and feeling.

Importance of Wurzburg School

In the history of experimental psychology Wurzburg School has its own importance. The main facts related to it are :

1. *Importance of tendencies and feelings* : In the Wurzburg school research work was done on the concepts of feelings and tendencies. This affected all the aspects of psychology.

2. *Research related to thinking* : After Buhler's experiments a flow of research work resulted in the sphere of thought. Tremendous research literature was compiled on the process of thought. Experimental studies were conducted on problems related to structure of concepts, thoughts, signs and symbols, mathematics, logic, aesthetics and ethics and also regarding research of unknown relations in the process of thought. Some of these studies were traditional in the Wurzburg whereas others started from different traditions.

3. *The emergence of experimental psychology in thought* : Whatever may be the allegation by the opponents on the experiments related to thought in the Wurzburg School Kulpe's research work and study of thought outside the Wurzburg School combined to create solid experimental psychology of thought. Mostly evolutionary study has been done in the psychology of thought. In other words it was endeavoured to find in what circumstances different kinds of thought start in the life of men. In this way, in the psychology of thought, questions relating to thought are concerened with problems of development and learning. In this way gradually in the psychology of thought, the problems did not retain the same form which they had for the experimenters of the Wurzberg School. Still we

cannot refuse to accept the truth that the experiments of the Wurzburg School laid the foundation of the experimental psychology of thought.

4 *The background of Gestalt Psychology*: As has been indicated earlier the Wurzburg School presented the background for Gestalt psychology. In this respect Mach's analysis of sensations is of great importance. Mach said that in changing the organisation of elements there occurs a change in the qualities of perception Therefore he has accepted spatial sensations which are distinct from the sensations of the elements of perception. It is clear that these experiments prove that the element of organisation presents some new facts in perception In 1890 Von Ehrenfels wrote in an article that there is something more than the order of different sounds in music A note in different music does different functions In this way *different music can be created from similar sounds* Hence Von Ehrenfels concluded that, other than the main elements, the organised forms have their own qualities This he termed as Gestalt Qualitate, or quality of organisation From these theories of Ehrenfels the main basis of Gestalt school is formed.

Still all studies of the Wurzburg school have a permanent place in the history of psychology Regarding determination and thought the conclusions of Wurzburg school were not accepted in that form later on. Woodworth and Titchener did not accept the imageless thought and neither could the experimenters of the Wurzburg school prove it definitely. The problems which Kulpe had presented for discussion, now come under the psychology of learning.

Q 83 Write short note on theories of thinking.

1 *Central Theory*—The ancient theory about the definition of thinking is called the central theory In this, as is clear from its name, the definition of thinking is done through the processes of the central brain and it is accepted that, at the time of thinking, there are actions only in the brain and there are no other physiological actions. No experimental evidence to prove the central theory could be given

2. *Motor or Peripheral Theory*—This theory was presented by the behaviourist psychologist, Watson. As is clear from its name, more importance, in this, is attached to various physiological actions in place of the brain actions In thinking, Watson laid special stress on the actions of the larynx and regarded language

and thinking as inseparable. Other behaviourists accept the presence of some other physiological actions also besides the actions of the larynx in thinking. This second opinion is considered to be importent specially; although the experiments, which were made to prove it could not furnish a common conclusion. An absence of sufficiently minute instruments is said to be the cause of difference in results of the experiments. It was found out from some experiments that there is an implicit movement in the tongue at the time of thinking; although this has not been proved fully. It was found out by noting down the movements of teeth and tongue at the time of thinking that these movements in thinking are not necessary. Here, some of the psychologists maintain that, whenever the actions of these organs are not seen, its cause is not the absence of actions but the absence of minute instruments to show them. In 1932, to prove Jakson's motor theory of thinking, experiment was made on twenty subjects to know whether there was some action in neuro muscular system at the time of thinking or not. It was concluded from the results of experiments that there was surely some action in the neuro muscular system at the time of thinking, although it was difficult to ascertain it through an external inspection. In 1935, through his experiments on dumb and ordinary subjects, Max proved that neuro action current in thinking is necessary to prove the motor theory. It was proved from experiments made by Max that there is no neuro action current in a dreamless sleep condition, while this action increases at the time of a dream. According to motor theory, the same kind of action is seen in the fingers of the deaf and the dumb at the time of thinking as is seen in the larynx of ordinary persons. It is clear from the various experiments that an action does take place in the nerves of many parts of the body at the time of thinking, but it does not prove that this action is compusory for all kinds of thinking. Therefore, all kinds of thinking cannot be defined through motor theory. If the central theory of thinking has not been proved through experiments, it could not, at the same time, be disproved. In the present condition, therefore, it cannot he said with any certainty as to how thinking of various kinds is performed. None of the present theories is capable of defining all kinds of thinking.

Q. 84. Write short note on importance of trial and error in thinking.

Importance of trial and error in thinking :

Solution of a problem is sought in thinking. In most of the

cases, trial and error method is used in the process of this solution. Although Kohler and many other *psychologists have tried to make* use of insight instead of trial and error in solving problems, yet most of the psychologists donot deny the use of trial and error in solving them. Even in experiments made by Kohler, Chimpanzees tried trial and error many times before reaching insight. In explaining this, Woodworth showed that, due to the presence of a gap in circumstances, solution of a problem is not seen immediately and therefore help from trial and error is taken. The solution of this gap is the real insight. The truth is that even the gestalt psychologists have given some importance or the other to trial and error in solving problems. As Woodworth has pointed out, trial and error does not mean doing an action aimlessly or without thinking. If it is accepted, most of the objections raised by gestalt psychologists can be removed. In making experiments on children, Wertheimer saw that in solving geometrical problems, help from trial and error was also taken along with that from insight But Wertheimer accepts no importance of trial and error in creative thinking. Other psychologists donot agree with him in this. The truth is that even great psychologists have taken help from trial and error to reach their difficult theories.

Gestalt psychologists donot accept the importance of past feelings in the solution of present problems. On the other hand, great stress has been laid on past experience in trial and error theory. In one experiment, Durkin divided a problem into many parts and asked various subjects to solve it separately. After that, he presented the whole problem. It was observed that the subjects solved the whole problem easily On the other hand, the subjects, before whom the whole problem was presented at one and the same time, felt great difficulty in solving it This experiment proved the importance of past experience in solving a problem But it does not prove that the importance of insight in solving a problem is less in any way In fact, it is from trial and error that we reach insight gradually. Therefore, the importance of trial and error in solving a problem cannot be derived

Thinking and Language :

Among all animals only man can think. One of its main reasons is that he is given the power of language Behaviourist psychologists have gone so far as to regard thinking as an implicit speech. Although this theory has not yet been proved, yet no

psychologist denies the importance of language in thinking. Not only Watson, but even Binet, before him, regarded thinking as sub vocal speech. Mueller differentiates between thinking without a language and thinking with a language. To prove the behaviourist theory of thinking, Clark, Thomson and other psychologists made experiments with the help of such instruments in which the movements of the larynx in the process of thinking could be seen. In the results of all these experiments, the movements of the larynx in the process of thinking could not be seen on all occasions. Even then, many behaviourists maintain that the absence of stlll more minute instruments is the cause of it and that the movement of the larynx in the process of thinking is not lacking.

It has been seen from common experience that all kinds of thinking cannot be explained through behaviourist theory. Some times it so happens that an individual speaks something and thinks something else. In such a condition, the relation of thinking with language cannot be regarded as compulsory. After studying some patients of aphasia, Held saw that although they could not express their ideas through language, because of brain injury, yet the process of thinking still existed in them. Held has given an example of such an English officer who showed the process of thinking even when he suffered from aphasia. This experiment proves that the process of thinking should not be regarded as a result of the action the larynx but its cause. It is clear from the above explanation that thinking and language are closely related, although both of them cannot be said to be similar.

Imageless thinking :

According to introspectionist psychologists, the existence of image is necessary in thinking. Thinking in the absence of image, is impossible. In experiments made by Wundt and Titchener, the subjects, in expressing their experience at the time of considering problems, said that different kinds of images presented themselves during thinking. It was also observed that there was often no use of images in thinking. In this way, introspectionists established the importance of image in thinking; but later, psychologists of the Wurzburg class advocated imageless thingking through their experiments. Wundt of Germany, Binet of France and Wood worth of America made experiments in this connection; but the most important experiments in this connection were made by the

psychologists of the Wurzburg class, named Kulpe, Marbe, Mueller, Messer and Buhler.

According to Wurzburg class of society, thinking is an integrated process which cannot be divided into different parts as sensations and images etc. In 1901, the psychologists of the Wurzburg class, in their experiments, found thinking to be imageless on the basis of the subject's introspection. Kulpe was the first psychologist to make experiments in this direction. After Kulpe, Marbe, in an experiment, instructed the subjects to compare two weights. It was not found from the information given by the subjects as to how they could discriminate between heavy and light. Marbe, with the help of G. F. Mueller and other psychologists, proved that images and sensations had no hand in discriminating between light and heavy. Some conscious tendencies like doubt, trust and hesitation etc were surely there in the subjects. Marbe gave importance to these tendencies in place of sensation, image and feeling etc. to be at the root of thinking Through his experiments, Titchener tried to show that many kinds of images were present in conscious tendency itself Contradicting this statement, Titchener, the psychologists of Wurzburg school of society, named Messer and Buhler, refused to acknowledge the presence of image and sensation in conscious tendency The psychologist, Alfred Binet also advocated imageless thinking by experimenting on his own daughters

Here it is necessary to pay attention to the fact that the psychologists of the Wurzberg class do not deny the presence of image of all kinds of thinking They only do not regard image to be unavoidable for thinking It has been shown through experiments that there are symbols in thinking and images rise from these symbols Imageless thinking has been proved to be impossible through the experiments of Woodworth. Comstock, Crossland, Gleason and other psychologists proved the importance of image in thinking on the basis of experiments Hollingworth, Bonsfield and Berry also drew conclusions of a similar kind from their experiments. By giving some mathematical questions, Borsfield and Berry wanted to know the kinds of images and their range of action in the thinking process of the subjects The subjects said that the visual images of the figures were helpful in solving the questions. These images were settled, stable and clear. Ideatic images, lasting for a long time, were seen in subjects at the time of

thinking and no change was seen in their form and kind. On th basis of this conclusion, Bonsfield and Berry showed the importanc of memory images in thinking, and proved that images were helpful in thinking. Among the experiments made separately by Okabe, Clarke, Pyle and Jacobson in Cornell laboratory of Titchener to know the importance of image in thinking, they gave no proof of imageless thinking. On the basis of his experiment, Clarke showed that the idea of imageless thinking was, in fact, based on impedi-ments created by a difference in the meaning and subject matter of thinking. Contradicting the conclusions reached through experi-ments made in Cornell laboratory, Odgen said that the images in thinking were seen by the subjects because they were instructed to tell the presence of those images.

It is clear, from the above explanation of the various experi-ments made in connection with the importance of image in thinking, that, while sometimes there is an image in thinking, the thinking is sometimes imageless. The first kind of thinking can be called concrete and the second kind of thinking can be called abstract.

Determining set in thinking :

The psychologists of the Wurzburg school have accepted the importance of a determining set in thinking along with a conscious tendency. A determining set means that a solution to a problem is imagined in a special extent limit which helps the process of thinking to flow in a special direction. In the absence of this determining set, an individual cannot have a sure solution to a problem present before him; although it cannot be concluded from this that a solu-tion through a determining set is compulsory, because this set can also have a wrong direction. It is necessary that a determining set s in a correct direction, because then alone it can help in solving a roblem. As has been said before, the psychologists of the Wurz-urg school advocate their opinion on the basis of various experi-ents.

By giving hypnotic suggestions to the subjects, Ach showed, ough his experiments, connected with thinking, that, not only scious but even unconscious determining set affects thinking. It ecause of this determining set that thinking becomes controlled full of aim.

In every psychological experiment, there are three kinds of ctions. Besides the instructions given by the experimenter, the

subject has self-instruction also and some other instructions he has to follow due to the situation of the experiment Because of a particular situation, the past experience of the subject also affects instruction. Determining sets are therefore created by controlling instructions and past feelings in the subjects. Maier showed, through his experiments, that there is a recombination of past experiences in thinking and a new relation among various things is seen through the same. Maier made the following experiments in this connection.

making inadequate determining set. Only one subject, out of sixty two subjects of the first four groups, could solve the problem. In this way, Maier concluded from this experiment that the importance of determining set in thinking was clear.

(2) Two ropes were hung from the ceiling of a room at such a distance that it was not possible to catch hold of both of them at one and the same time. There could be many ways to catch hold of both the ropes, but Maier was to test only one way in which the subject was to stand with one rope in his hand, was to tie a heavy object at the end of the other rope and was to swing the other rope so hard that it reached near the first rope to be caught easily. The subject was given ten minutes to solve the problem. Many unnecessary articles were present in the room. When the subject failed, two hints were given to him and the rope was made to swing hard once more. The other subject was given a weight and was told that it could help in solving the problem It was seen in the result of the experiment that thirty nine per cent subjects solved the problem without any hint. After a hint was given, other thirty eight per cent subjects solved the problem. From this, Maier concluded that a solution of a problem was easy after receiving sure hints.

(3) The subjects connected with this experiment were such as could not solve the problem due to a change in behaviour. In the experiment, the subjects were divided into two groups. The first group was told for twenty minutes the various actions of solution to the problem. The second group was not told any thing. It was told that if the problem was not solved, the behaviours should be changed and another alternative should atonce be used Three kinds of problems were placed before the subjects. In one problem, the instruction was given to put out a lighted lamp placed at a distance through small tubes and clamps. In the second problem, the rope problem, described before, was presented. In the third problem, instruction was given to unite the planks with the help of clamps and then to make a peg to hang a hat on. The rope problem was successfully solved by about fifty per cent subjects belonging to both the groups. In this ways in solving this problem, there was no difference in both the groups, although it was certainly seen that the subjects of the controlled group, as compared to those of the experimental group, took some more time in solving the problem. The problem of putting out the lamp was solved

by about twenty five percent subjects of both the groups. Even among these, the subjects of the controlled group, in comparison to the subjects of the experimental group, took a long time more. In the third problem, while sixty eight percent subjects of the experimental group were successful, only forty seven per cent subjects of the controlled group could succeed From this, the importance of the determining set in solving a problem becomes clear.

From all the three experiments of Maier, given above, the importance of the determining set in solving a problem becomes clear.

As has been said before, when the determining set is wrong, it makes the solution of a problem still more difficult, instead of helping it, in the same way as a favourable determining set helps in changing a difficult problem into an easy one. A psychologist named Luchins concluded from his experiments that the subjects, after solving many difficult problems, could not solve a very simple problem; because at the time of solving difficult problems, a determining set favourable to them was formed in the subjects and this same determining set proved an impedinent in solving a simple problem. It is thus clear that a favourable determining set is very necessary for solving problems.

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19

Intelligence and Intelligence Tests

Q. 85. What is the nature of intelligence? How is it measured? *(Baroda 1963)*

Definition of intelligence

The word intelligence forms part of our ordinary stock of words which we use every day. In the field of psychology too, the word intelligence finds a fairly comprehensive use, but it has been defined in a number of ways by the scientists. Some of these definitions are given below :

1. Intelligence is the ability of adjusting in a new situation : According to Wells, "Intelligence is the property of recombining our behaviour pattern so as to act better in a novel situation." In William Sterns' opinion, "Intelligence is the ability to adjust oneself to a new situation."

These definitions are faulty in the following respects :

(*a*) They fail to clarify the full scope of intelligence.

(*b*) Intelligence and adjustibility are not the same. Intelligence is innate but adjustability is mostly learnt.

2. Intelligence is the ability to avail of past experience : Both Ebbinghaus and Thorndike define intelligence as the ability to make profitable use of past experience. In other words, intelligence is the ability of learning.

The definition has the following defects :

(*a*) Learning and intelligence are not identical because learning depends on many things besides the latter.

(*b*) This definition does not describe the full scope of intelligence.

3. Intelligence is the ability of abstract thinking : According to Garret, one may define intelligence as including "the abilities demanded in the solution of problems which require the comprehension and use of symbols." In Terman's opinion, "Intelligence is the ability to think abstractly."

This definition suffers from the following defects :

(*a*) Abstract thinking is not intelligence, it is only a part of intelligence.

(*b*) This definition fails to describe the complete scope of intelligence.

4. Intelligence is the conglomeration of many powers : In Wechsler's opinion, "Intelligence is the aggregate or global capacity of an individual to act purposefully, to think rationally and to deal effectively with his environment" Computing the different powers of intelligence, Husband has said, "An intelligent person uses past experience effectively, is able to concentrate and keep his attention focussed for longer periods of time, adjusts himself to a new and unaccustomed situation rapidly, with less confusion and with fewer false moves, shows variability and versatility of response, is able to see distinct relationships, can carry on abstract thinking, has a greater capacity of inhibition or delay and is capable of exercising self criticism "

Actually, Husband has given a very good description of an intelligent person but intelligence cannot be accepted to be the sum total of all these qualities. The psychologists, however, differ in their assessment of intelligence as a power or a collection of many powers A description of the different theories concerning the nature of intelligence will help us to understand the various interpretations of the form of intelligence

Theories of Intelligence .

The following are the main theories concerning the nature of intelligence .

1. Monarchic Theory This theory holds that intelligence is one power or energy which effects all the activities of the individual. According to Victoria Hazlitt, intelligence is a general ability which determines the various specific abilities. This theory has been proved to be fallacious Prominent people show a less than average ability in many activities For example, Darwin has a very bad handwriting

2 Oligarchic Theory This theory postulates that intelligence is an aggregate of mutually independent powers Binet believed this theory Experiments disproved this theory by showing that mental powers are interdependent

3. *Multifactor or Anarchic Theory*: Thorndike is the most prominent among those who believe this theory. This theory holds that intelligence is the mean of undetermined independent rudimentary elements. But Spearman has criticised this theory.

4. *Two factor Theory*: This theory was conceived by Spearman who holds that intelligence has two parts—(1) General Intelligence or G, and (2) Specific Intelligence or S. General intelligence effects every activity but the effects of the specific intelligence are confined to specific activities. General intelligence is found in lesser or greater degree in every one. Specific intelligence is of various types, the several types being independent of each other. They differ from individual to individual. This intelligence of a person depends on his general intelligence.

Staffens and Brown have upheld Spearman's theory on an experimental foundation. But Pears asserts that adequate experimental data, in its favour, is not available and consequently even Spearman's theory cannot be said to be universally acceptable.

In reality enough experiments are still needed to formulate an all-embracing definition of intelligence. In this connection, a universally acceptable theory has yet to be worked out.

Q. 86. Write short note on Types of Intelligence Tests.

TYPES OF INTELLIGENCE TESTS

Intelligence tests are classified according to the activities prescribed in them—

1. Verbal Tests.
2. Non-Verbal Tests.

As the name itself suggests, Verbal tests make use of language while the non-verbal tests include such activities which do not necessitate the use of language. Both these types are suitable for individual as well as group tests. Consequently, Verbal and Non-verbal tests are capable of further subdivision into two classes—individual and group. Thus, finally there are four types of intelligent tests—

1. Verbal Individual Intelligence Tests.
2. Non-verbal Individual Intelligence Tests
3. Verbal group Intelligence Tests
4. Non-verbal group Intelligence Tests

VERBAL INDIVIDUAL INTELLIGENCE TESTS

The very name verbal individual intelligence tests, suggests that these are intelligence tests given to individuals, or in other words they are meant to test the intelligence of the individual. Language finds adequate use in them. Binet Simon tests and the various revisions are all included in this classification.

Hindi version of the Terman-Merrill Scale

The Central Bureau of Psychology of Uttar Pradesh has made a Hindi Version of the Terman Merrill Scale. This revision includes a variety of material, from solid objects to difficult questions. The activities in the beginning are simple like constructing a bridge or a tower of blocks or fitting in irregular wooden blocks in their proper place supplied for them At the same time, at the end of the tests there are difficult questions which need considerable thinking. This test is divided into numerous age groups. The higher age groups use language to a considerable extent and its use gradually declines with the age group. For example, the two years group include the following activities :

1. The form panel with three holes,
2. Recognition of objects by name,
3. Recognising the organs of the body,
4. Making a tower of blocks,
5. Naming an object from its picture,
6. Word order.

The various types of activites in the "superior adult third" are as follows :

1. Vocabulary
2. Sense of direction
3. Paper cutting
4. Logical reasoning
5. Repeating nine digits

Non-Verbal Individual Intelligence Tests

It is quite apparent from the above example that in verbal tests, the child's knowledge of language is more in demand and therefore the use of these tests is limited to students or literate persons. But these verbal tests cannot be used in the case of illiterate individuals as these tests involve an extensive use of language which fails as a medium to measure the individual differences between the illiterates. Consequently, illiterate individuals are

tested with the help of Non-verbal individual intelligence tests. The name itself indicates the nature of these tests. These tests involve the least possible use of the linguistic ability and are similarly almost unaffected by knowledge derived from books. One example of these non-verbal tests is the Performance Intelligence Tests.

Performance Intelligence Test :

It would be in keeping with the context of our discussion to understand in detail the Performance intelligence test as an example of the non-verbal individual intelligence tests. According to Munn, "The word performance is usualy applied to tests which require a minimum use of understanding and language." Thus, these tests make use of items requiring responses and not language and these tests can be applied to children, illiterates, feebleminded individuals as well as to foreigners.

Pinter-Patterson Performance Scale :

One example of the performance intelligence tests is the Pintner-Patterson Performance Scale. It was evolved by Pintner and Patterson in 1917. In this scale there are 15 types of tests, of which 7 are form boards, 6 picture completion, memory span and the rest are picture puzzles and imitations etc.

Porteus Maze tests :

Another example of the performance intelligence tests is the Porteus Maze tests. In it paper and pencil mazes are used. For his test, Porteus created mazes for children from 3 to 14 years. It gets difficult, corresponding to the increase in age. The subject is allowed two chances and if he fails in the attempt then the conclusion is that his intelligence is not of that age level. Children of 12 or 14 years are given four opportunities. These tests designed by Porteus not only measure intelligence, but they also reflect at the same time the nature of the individuals. It is distinguished from tests in as much as that it includes some aspects ignored by such tests as the Stanford Binet tests.

Form Board Test :

A comparatively simple example of the performance-intelligence test is the form board test, among them the tests of Seguin and Goddard deserve special mention. In the form board test, there are numerous blocks and a board in which there are holes corresponding to blocks. The subject has to fit the blocks in

these corresponding holes in the board, the time taken and mistakes committed being noted from which the score of the test is calculated.

Wechsler Bellevue Test :

Another example of the performance intelligence tests is the Wechsler Bellevue test evolved in 1913, meant for people from 10 to 60 years of age. Speaking on the subject, Shaeffer and Lazares worte, in a modern clinic, these tests are included in the Binet class as one of the most important. In this way it is the most apt test for measuring the intelligence of adults. In this test there are five verbal tests and five performance tests. This test affords not only an index to mental abilities but also a profile of abilities.

Bhatia's Battery of Performance Tests :

The description of performance intelligence tests would be incomplete without a mention of Bhatia's battery of performance tests. It is the battery created by the former director of Uttar Pradesh psychological laboratory, Dr. Chandra Mohan Bhatia. It has the following 5 subtests—

1. Kohez Block Design Test—10 types of tests out of the Kohez block design test have been included in the battery. There is one card on every subject upon which is depicted a colour design. The subject or the examinee sees this design and makes a similar one out of the blocks. These designs become correspondingly more and more complex, having been simple at the start.

2. Alexander Pass Along test—The Bhatia battery also includes the Alexander Pass Along test, in which too there are some designs seeing which the subject shifts coloured pieces in an open box and places them in a similar design

3. Patterns Drawing Test—This test has been created by Dr. Bhatia himself In this there are eight cards on each of which there is a one-line figure The subject draws a particular figure or pattern after seeing this figure.

4. Immediate Memory Test—Some digits are recited, which are immediately repeated by the subject, this ability throwing some light on the immediate memory of the subject

5. Picture Construction Test—In this subtest there are five subjects, in which pictures relating to the Indian rural life are fragmented into respectively 2, 4, 6, 8 and 12 pieces. At one

pieces of one picture are placed before the subject who puts them in order and constructs the picture.

Besides these tests the Uttar Pradesh Bureau of Psychology has prepared a battery of performance intelligence tests for children of 4 to 10 years.

Difficulties in the Individual Intelligence Tests

Some difficulties are felt in the operation of both the verbal and non-verbal types of individual intelligence tests. They are roughly as follows :

1. *The difficulty of time* : The individual intelligence test takes an hour usually and only one person can be tested at one time. Obviously, at this rate it would be essential to have a very big number of trained examiners and in spite of that it would be difficult to test all the people.

2. *Need for experience in examiners* :—The second obstacle, in the individual intelligence tests, is the need for experienced examiners because the correct result cannot be arrived at if the examiners are inexperienced. At the same time the availability of such a large number of trained personnel is a near impossibility.

Not withstanding these difficulties, in some circumstances the individual intelligence tests become unavoidable. This is because the level of accuracy reached by the individual intelligence tests in the assessment of a person's intelligence, is outside the reach of the group intelligence tests.

VERBAL GROUP INTELLIGENCE TESTS

The group intelligence tests owe their origin and evolution to the difficulties from which the individual tests suffer. As the name suggests those tests are designed to test the intelligence of a group and not of an individual. All the people in the group are given the same directions and have to perform the same activities. Even the score of the result of group intelligence tests is calculated by machines thus dispensing with the necessity of skilled examiners accompanied by an economy of time.

Army Alpha and Beta Tests

An excellent example of group intelligence tests is afforded by the Army alpha and beta tests, which were evolved during the World War I in order to test the American soliders. For example it revealed separately the feebleminded, men capable of becoming

skilled specialists, men capable of becoming officers, men needing some training, etc.

Naval and Army general classification tests

Due to the success which attended these tests, some group tests for classification of naval and army soliders were evolved during the Wold War II, and of these two particular forms deserve mention. The two are :

1. Naval general classification tests.
2. Army general classification tests.

With the help of classification made by Cruze, some one billion people were tested by the military general classification tests during the years 1941 to 1946. In the tests there are three subjects for the testing of problems resulting to vocabulary, problems relating to mathematics and problems of counting blocks.

Dr. Sohan Lal's Intelligence test

The psychological laboratory employs the group test evolved by Dr Sohan Lal for 11 year old children. Tests were also designed for 13, 14 and 15 year old children and even for adults.

Some of the subjects included in the tests, for 11 year old children made by Dr. Sohan Lal, are as follows :

In the following example the word head has been italicised because the boy must have a head even if he does not have the other objects. The example goes thus :

Essential :

in the boy .. (Coat, shoe, bag, *head*, cycle, ball).

After seeing the above example, the subject has to underline the correct answer to some questions. Some examples of such sentences are

33—In the forest (Lion, bear, snake, puddle, thorn, tree).
34—In the sea . (Ship, aeroplane, water traveller, fog, cold).
35—In the ice (blanket, sawdust, matting, dirt, fog, cold)

Of the subject included in the tests for 13 years old childern some of the following five words are given in an example. One of these words which is in no way related to the remaining four is underlined. From this example, the examinee marks out words of a similar type. For example

Corduroy, silk, *leather*, Worsted, georgette

The following are examples of questions given for solution—

1. Dog, cow, bull, hen, horse
2. Temple, mosque, church, gurudwara, dharamsha

From the above example, it is quite clear that these verbal group intelligence tests examine the reasoning power, power of comparing and contrasting, sense of direction, ability in numerals and language, of the individuals who constitute the group. It is essential that the examiner should be fully acquainted with the tests and he should also understand the corresponding directions. Thus, often the examiner examines himself to start with. At the same time, it is necessary for the examiner to have some knowledge of the mechanical aspects of the conditions of examination such as the proper seating arrangement of the examinees, the distribution of test blanks, and the preparation of material related to tests, like pencils etc.

Difficulties in the Verbal group intelligence tests

Even after taking all the precautions, some difficulties are discernible in the verbal group intelligence tests which can be eliminated only by reverting to the individual intelligence tests. It is due to these difficulties that the individual intelligence tests are considered more realistic than the group intelligence tests. The difficulties of the verbal group intelligence tests are fundamentally as follows—

(*1*) *Difficulties relating to co-operation in tests*: In these tests it is difficult to judge whether the examinee is extending his full cooperation or not.

(*2*) *Difficulty related to the balance of the subject*: In these tests it is difficult to determine whether the physical and emotional balance of the examinees is even or disturbed.

(*3*) *Difficulty related to the ease of the subject*: In the verbal group intelligence tests it is difficult to ascertain if the examinee is feeling at ease and free or restrained.

(*4*) *Possibility of cheating by the subject*: Another difficulty in these tests is that no one can testify whether the person has written the answer himself or copied it from his neighbour.

Inspite of the difficulties which arise in the verbal group intelligence tests, they have their own advantages due to which they are used comprehensively. As has been said before, the advantages are the same as the difficulties of the individual intelligence tests.

Non-verbal Group Intelligence Tests

As has been mentioned before, the verbal intelligence tests are meant only for the literates because of the requirement of a

linguistic ability. It is for this reason that the non-verbal group intelligence tests have been created, the examinee making a minimum use of language but performing, instead, many activities. One example of the non-verbal intelligence tests is Cattel's Culture free test and the N. I. I. P. test. An example of the subjects given in these tests is as follows :

In a given picture there are 3 squares with some vacant space for the fourth square. There are some figures drawn in the three squares. On the left various figures are shown in five squares. In the given diagram, the fourth square has to be filled with one such figure from the five squares that its relation to the third square must be the same as the relation which the figure in the first square bears to the figure in the second square.

In these non-verbal group intelligence tests, the examiners have to explain to the examinees even the simplest directions which are also demonstrated as far as possible. All this is done to make the least possible use of language There are some performance tests in the group intelligence tests, in which the examinee draws some lines according to his abilities, fills in some empty spaces, draws some simple figures, or performs some simple activities Some psychologists do not give credence to these non-verbal tests in their role of measuring intelligence of the subjects while on the other hand some psychologists consider them to be better than verbal tests For example in Alexander's opinion, "A complete performance battery will be a better measure than a complete verbal battery "

The truth is that even if non [illegible] intelligence tests are not more important than [illegible] they are certainly not less important than these tests [illegible] peculiarities are as follows :

Peculiarities of the Non Verbal Group Intelligence Tests

(1) Comparison of [illegible] The first obstacle in the comparison of human groups [illegible] various languages and cultures is the difference in the [illegible] This obstacle can be overcome by the non verbal group intelligence tests and a comparison between different human groups is rendered possible.

(2) The testing [illegible] *The verbal group intelli-* gence tests are manifestly inapplicable to illiterate soldiers for the testing of their intelligence Consequently the abili[illegible]

soldiers are assessed by employing the non-verbal group intelligence tests and the possibilities of their learning are known.

(3) *Intelligence testing in children* : The linguistic ability is very low in the case of children and consequently the verbal group intelligence tests cannot be given to them. Apparently, intelligence testing of children will have to be done by the non-verbal group intelligence tests.

(4) *Advice to some specific classes* : The above exposition on the non-verbal group intelligence tests has made it obvious that these tests have proved the most successful with same specific classes of people. Thus, the results of these tests render great assistance in advising people of this group.

Q. 87. Write a short note on—I. Q.

(Vikram 1968; Agra 1967; Karnatak 1964)

Ans. The idea of I.Q. was utilised first of all in 1916 in the Stanford Binet tests. I.Q. is the ratio between mental age (MA) and chronological age (CA). The chronological age is determined from the date of birth and the mental age by tests. For example, if the average score of children of 13 years in age turns out to be 75 in some tests then any child whose tests reveal an average of 75 will be said to have a mental age of 13, whatever be his chronological age. After 14 years of chronological age, mental age does not increase. Even children of the same mental age may differ. Mental age does not increase with the chronological age. Having understood properly the mental age, it is easy to understand I. Q. The equation for the calculation of I. Q. is as follows :

$$\text{I. Q.} = \frac{MA}{CA} \times 100$$

As is evident from the above equation, to calculate I. Q. (Intelligence Quotient) the mental age is divided by the chronological age and then multiplied by 100. To take an example, suppose a four years old child has a mental age of three years. His I. Q. will be calculated with the help of the following equation :

$$\tfrac{3}{4} \times 100 = 75$$

The Limitation of the Concept of I.Q.

Actually, the I.Q. reveals the mental ability of the individual on the basis of which he can be directed about his future. It is

essential to keep in sight the limitations of the concept of I Q. in order to understand it well enough. It's main limitations are as follows :

1. I. Q is not the quantity of a person's intelligence.

2. All the tests do not yield an identical I. Q Consequently none of the I. Qs indicated by any one test is completely reliable.

3. No person is devoid of intelligence so that I. Q. does not start from zero.

4. I. Q. changes at least once every three years.

Permanence of I. Q.

1. Even when a person is examined by the same test a number of times, the I. Q. shows a change. This difference differs from test to test. For example, in Weschler Bellevue Test, the difference is upto 5 points whereas in the Stanford Binet tests it is upto 4 points.

2. The I Q of every child does not remain constant In one it registers a very appreciable change.

3. I Q is the result both of heredity and environment. Thus a change in environment may change the I. Q. According to Garret the good or bad environment may show a difference of 10 points

Classification according to I Q

In his book 'Great Experiments in Psychology', Garret has classified people according to their I Q and shown their percentage in the population, as in the following table —

I. Q.	Classification	Percentage
140 or above	Very Superior	1 5
120 to 139	Superior	11
110 to 119	Bright	11
50 to 109	Average or Normal	45 0
80 to 89	Dull normal or Backward	14 0
70 to 78	Very dull	5 0
0 to 69	Feeble minded	2—5

In this context, some other important things known from experiments are

1. There is a possibility of increase in I. Q. along with a rise in the social and economic status and a possibility of decrease in I. Q. with degradation.

2. The I. Q. generally remains constant from 5 years to 14 years of age.

3. The mental level develops gradually.

I. Q. and success in school work

Many scientific researches have made it clear that there is no invariable relation between I.Q. and success in school work. But in children with a higher I. Q. there is a possibility of success in school work.

20
Personality

Q. 88. What is meant by personality? What are the factors which determine it? *(Bombay 1954, 59, 58, 52; Karnatak 65, Punjab 62)*

Ans. Ordinarily, personality is taken as the external appearance of the individual. In philosophy the meaning of personality has been interpreted in the sense of the internal self. But in psychology neither is the personality the external appearance nor is it the internal self, but it includes both and much more. The word personality has been derived from the Latin word Persona. The word Persona was used for the cover, utilised by the actors to change their appearance, but in the Roman times it was taken as the particular character itself. This second meaning has been taken in the modern word personality. Thus personality is not a fixed state but a dynamic totality which is continuously changing due to interaction with the environment. Personality is known by *the conduct, behaviour, activities, movements and everything else* concerning the individual. It is the way of responding to the environment. The way in which an individual adjusts with the external environment, is personality. In the words of Munn, "Personality may be defined as the most characteristic integration of an individual's structure, moder, behaviour, interests, attitudes, capacities, abilities and aptitudes." Behaviour requires integration. This integration of various traits is found differently in different person. As a general rule every healthy individual has some sort of integration. The peculiar forms of integration in a particular individual are his personality traits. Thus personality is the most characteristic integration of an individual. It is personality which marks distinction in one man and another. In the words of Gordon Allport, "Personality is the dynamic organisation within the individual of those psycho-physical systems that determine his unique adjustment to his environment." The personality is the organisation of the internal and external activities. It includes the external appearance, qualities, aptitudes and capacities etc. It is the result of the inter action of the individual with the environment. It is

not a collection of the traits, but a particular organisation of them. It is the total quality of the individual's behaviour. Individual affects other individuals through his personality. Thus personality is manifested in his various activities. In sort, personality is the total quality of the behaviour, attitudes, interests, capacities, aptitudes, and behaviour patterns, which are manifested in his relation with the environment.

For some time there was discussion among the psychologists about the relation of heredity and environment in the development of personality. In this discussion arguments were given from both sides and much matter was gathered on the basis of observation and experimentation. It was found by this data that the development of personality depends upon both the heredity and the environment. Hence modern psychology includes both heredity and environment in the factors influencing personality.

According to Gordon Allport only the relatively stable aspects of behaviour should be recognised as personality traits. In his book, "*Personality a psychological interpretation.*" Allport writes, "From the evidence now in hand, four important conclusions may be drawn :

(1) Personality, defined as the distinctive mode of adjustment adopted by each individual in his efforts to live, is not formed at birth, but it may be said to have begun at birth.

(2) The earliest distinctive adjustment in respect to which infants can be said to differ, are in the intensity and frequency of their spontaneous activity (mobility) and in their emotional expression (temperament). Both these factors are primarly products of inheritance.

(3) Probably not before the fourth month is there sufficient learning and maturation to form distinctive habits of adjustment or rudimentry traits. But by the second half of the first year, adoptive response to the physical environment and to behaviour so marks distinctiveness.

(4) Distinctive qualities noted early in life tend to persist. The child seems pre-disposed to learn certain modes of adjustment and reject others. Even before these adoptive forms are clearly defined an observer can often, by the method of 'prophecy' predict later traits. Irrespective of the method used in the study of the consistency of early development, the evidence is

positive, virtually in every case." Thus heredity influences the biological features of personality. As a matter of fact, the heredity does not determine personality completely, nor is it ineffective in it.

See Next two Qs and Ans.

Q. 89. Discuss fully the biological determinants of personality. *(Patna 1962, Alld 1956, Raj. 1964, Agra 1954, Muzaffarpur 1965)*

Factors affecting Personality

The factors affecting personality can be divided into two classes—(1) Biological and (2) Social. The biological factors affecting the develpment of personality are of three types: (1) Ductless Glands (2) Physique and (3) Nervous System

Endocrine Glands

Ductless glands send their secretions directly to the blood without ducts. Their secretions are called hormones. These hormones are responsible for many changes in the personality. Different glands secrete one or more type of hormones. A description of the effect of some of the ductless glands will show the extent to which personality is influenced by them.

(1) Pancreas—Pancreas send insulin to the blood. The amount of sugar in the blood depends upon the amount of insulin in it. When the deficiency of insulin *i.e.* sugar, is in the body the mental powers are weakened and the personality of the individual seems less balanced. His mood is changed, temperament becomes irritated and fear increases.

(2) Thyroid Gland—Thyroid gland has a very important function in the development of physical structures as well as mental development. If it is absent since the very birth the intellect of the child does not improve. Cretins, imbeciles etc., are the result of the absence of thyroid gland. Its destruction causes a disease known as myxoedema. This disease creates laziness in man. The activities of the mind as well as those of muscles are slackend. The memory become weak, man is not easily concentrated and thinking becomes difficult. In the period of development the excess of the activity of thyroid results in rapid physical growth, specially the development of height. An excessive activity of this gland results in rapid physical growth, specially the development of height. A deficient activity of this gland results in tension, irritation, worry and instability in man's personality. Thus with

the increase or deficiency in the activity of thyroid gland, the activity of the body as well as of the mind also increases and decreases. But this does not mean that the increase and decrease of the activity in the body is always due to the effect of thyroid gland. Occasionally, it might be due to other causes as well, but thyroid gland does play an important part in them.

(3) *Adrenal Gland* -Adrenal gland secrets adrenaline. Adrenaline has an important influence upon personality. Its excess creates the sexual traits in men or women. Its excess in women is responsible for the absence of the rounded contours and feminine voice. It organises the organic capacities in the time of emergency. The excess of adrenaline causes rapid heart-beat, high blood pressure and the postponement of the activity of the intestines. The individual having less adrenaline feels relaxation in the muscles, more sweat and the pupils of the eye are extended. An entire absence of adrenaline results in the disease known as Addison's disease. In this disease one feels weakness and lethary in the body, power of resisting disease is lessened, the interest. in sex activity disappears and metabolism becomes slow. The skin becomes black, the power of resisting heat and cold is lessened and behaviour becomes irritable.

(4) *Gonads*—The secretion of the gonads *i.e.*, sex glands, is an important factor influencing personality. Gonads separate sex hormones Sex hormones are very much helpful in the increase of sex interest. In adolescence there is a special increment in the hormones, Hence changes are observed in the individuals according to their sex. In man one finds the manifestation of masculine characteristics such as beard, moustaches, high pitch in voice etc., while in the female there is development of mammary glands and other womanly traits. The processes concerning pregnancy *e. g.* mensus, pregnancy, the bearing of the child and maternal behaviour is very much influenced by the sex hormones.

5. *Pituitary Glands*—The hormones secreted by the pituitary glands control other glands. The hormones secreted by the front part of the pituitary gland increase the activity of their glands as well. The hormones created by the back part of the pituitary glands control the blood pressure and the metabolism of water in the physical activities. These hormones also affect physical growth. In the time of physical growth the bones and muscles of the individual grow speedily due to the activity of these glands. In its

excess, the height can go even upto 7 to 9 feet. But because after excessive activity this gland becomes very much inactive, these very tall persons die at an early age If the activity of the pituitary gland is very much deficient in the time of development, individual remains a midget, though his intellect is normal and the physical structure is not un-attractive. If the activity of this gland is normal during the development period and becomes excessive afterwards, the hands, feet, nose and lower jaw etc., become broad. This state is known as acromegaly.

The effect of the hormones is influenced by the heredity as well as by the environmental factors. But still the excess or deficiency in their activity create some changes quite apparent in the personality of the individual. It is not necessary that the excess of the secretion of any one of the particular gland should always show some special influence in the body *e. g.*, the excess of sex tendency should not always be supposed as due to the excess of the secretion of the sex gland, since different glands also interact upon each other due to which the activity of some is increased while that of others is decreased The sex behaviour, for example, is very much influenced by social norms, customs, circumstances, habits and many other things. Hence, inspite of the deficiency of the sex hormones, the individual may appear to be very much interested in sex activities. On the other hand, inspite of excess of the sex hormones, the individual may not appear to be interested in sexual activities.

Physique

Another important biological factor affecting personality is physical structure. It is seen in daily life that often the fat men are easy going and social, while the thin persons are self-controlled, irritated and un-social Thus the physical structure has some relation with the temperament But even the instances contrary to this rule are also existing. As a matter of fact the relation of physical structure and the temperament has not been definitely established. More experiments are required in this direction. The experiments conducted so far have been mostly on college students. Before one arrives at some definite conclusion, experiments must be conducted on adult persons as well. But even after that, the problem of the basis of co-relation remains unanswered. Simply by co-relation the temperament cannot be [illegible] result of physical structure. It should also be [illegible]

context that the physical structure makes a difference in other's behaviour towards different individuals is modified, to some extent, according to their physical structure. This difference in our behaviour makes a change in their personality. Hence, a particular difference should not be supposed due to physical structure alone but also due to other's behaviour towards the particular person, though the former may be more important

Body Chemistry

Another important biological factor affecting personality is body chemistry. In ancient times, the difference of temperament were supposed to be due to difference of chemical elements in different men Thus the nervous personality was taken as the result of excess of nervous fluid. It was supposed that the sanguine persons have an excess of blood, the choleric persons an excess of bile, phlegmatic persons an excess of phlegam and the melancholic persons, an excess of spleen. This principle is not accepted in modern psychology, but still no psychologist denies the relation of personality with the proportion of chemical elements in the body. These chemical elements are of two types. Some reach the body from outside while some are created in the body itself. Thus the drugs have sufficient effect on personality. The behaviour of the drunkard is an example of such effect. Different types of intoxicating drugs have a clear influence upon the personality of the individual. The deficiency of different vitamins also causes some change in the personality. With the increase or decrease of the quantity of sugar in the body, the physical and mental state of the man is very much changed. In convalescence one finds a difference in the individual's personality. Difference is also noticed after long illness.

Besides the above-mentioned biological factors many other factors influence personality, e.g., sex, intelligence, intellect and nervous system etc The difference in the sex of male and female creates an essential difference in their personality, though it has been established that much of this difference is caused by social and cultural environment. Galton and Goddard believe that intellect is absolutely hereditary. The modern psychologists do not agree with this hereditary view though the influence of heredity is not denied. The environment affects intellect, but the development of intellect is ultimately limited The influence of special talents, as that of music, mathematics etc, on human personality is very well known. Like the intellect, the talents are also generally

hereditary. According to Kempf, the author of *The autonomic function and personality*, the nervous system is one of the important determinants of personality.

Q. 90. Bring out the contribution of social factors to the development of personality. *(Gorakhpur 1952; Benaras 65)*

Explain the role of family and school situations in the development of personality. *(Mysore 1967)*

Social Factors Influencing Personality

The environments of different individuals are very much different from one another and so also their effects, but the influence of environment on personality can roughly be divided into that of home, [school and society All these three play an important part in the development of personality

Influence of Home on Personality

The environment of the home has a wide influence on the development of personality This influence, as a general rule, is according to the pattern found in a particular culture. In the family the relation of child with the parents is the most intimate. The cultural development of the child is very much influenced by the behaviour of the parents, *e g*, a child brought up in Indian family will by very much different in his behaviour than another brought up in Western culture But even in the same culture much difference can be observed in the parent-child relationship in different families, *e g*, generally the child has a respectable place in Indian family, but all Indian parents do not sufficiently love and sympathise with the child In such circumstances much repression is observed in child's behaviour He becomes an introvert and often enjoys in his dreams, day dreams and imaginations things which are denied to him by his parents The influence of the presence of the parental love is again not the same in the case of all children. A child may become aggressive while another may become submissive in the same circumstances On the other hand if the parents show excessive affection towards the child the child may become an extremist and excessively dependent upon the [illegible] A child excessively ignored shows different types [illegible] personality Children brought in the psycho[illegible] cure of defects of personality showed that [illegible] their defects was the behaviour of their pa[illegible] According to Sigmund Freud the tende[illegible]

parents in the childhood is manifested in the tendency to depend upon the leader in the adult age. If the child is allowed freedom in the matter concerning his belongings food, clothes, books etc., he will develop a habit of freewill, if all these are divided by his parents he will not get an opportunity to utilize his judgement and so become over-dependent submissive.

Parents are more powerful and efficient than the child. Hence they are the ideals before him, The child wants to become like his parents. Thus he establishes his identification with either of the parent and tries to follow his manners, ways and behaviour. The child also fulfils his frustrated desires through this identification. It has been observed that the little boy wears the big shirt of the father and walks proudly like him with a stick in his hand. This identification with the parents in the childhood is later on converted into the identification of the individual with the leader. By the identification with the leader the individual is happy in the leader's achievements and sorry in his failures.

In the absence of affection and sympathy, the child often turns criminal. While discussing the causes of criminal tendencies, Healy and Bronner have emphasized three factors, the effort to get rid of the painful circumstances, the tendency to revenge for the mis-behaviour of the father, the efforts to satisfy the frustrating desires. Often the child has the curiosity as to where from the younger brother or sister has come. The answer to this question by the parents has an important effect on his personality. The child has a natural curiosity towards the sex tendency. Often the parents try to suppress his curiosity towards sex or they just rebuke when he asks such questions But the child is not silenced by this He tries to enquire from the servants or friends in the house. But this leads to guilt conscience. The reactions in the parents about the every day matters in the family also affect the personality of the child. The relations of the mother and father among themselves also affect the personality of the child. In short, every behaviour of mother or father and the circumstances in family affect the personality of the child more or less.

It has been observed that the behaviour of the eldest and the youngest, the elder or the younger is not the same in the family. Similarly, it has been found that the parents' behaviour towards them is not also the same. This has led the psychologist Alfred Adler, to emphasize the importance of birth order in the develop-

ment of personality. The birth order of the child fixes the status in the family which decides his roles which affect his personality. The youngest child is treated with affection by everyone, hence he becomes over-dependent. The eldest child becomes self sufficient and tyrant, because being the only child for some time he does not share his rights and things with others. The birth of another child in the family has an important influence on the first child, since it takes away his monopoly in affection and sometimes he is neglected altogether. Hence he feels jealous with the younger child and tries to regain his rights. On the other hand, the new child is anxious to make his place in his family. The above description of the child's problems based upon the conception of birth order has been conclusively proved. The researchers have found similar conflicts in different birth orders. Adler has truly said that the individual develops his style of life from the pattern of his early life in the family, but there are no grounds to suppose that this style of life remains unchanged in future. It cannot be denied that the environment in the childhood is one of the most important factors determining personality, but it is difficult to believe with Freud and Adler that the personality of an individual is completely determined in childhood.

Q. 91. What do you understand by measurement of personality? Describe in brief the important methods of personality assessment. *(Baroda 1973, Raj[illegible] 1965)*

Ans. Psychology employs a number of methods by which it measures personality, e.g., situation test, psycho-analytic test and projective method etc. Besides these, the case history method, interview and questionnaire and rating methods have their own importance. Briefly, the methods of measuring personality are—

1. Case History Method
2. Interview Method
3. Questionnaire Method
4. Performance Method
5. Rating Method
6. Situation Test
7. Psycho-Analytic Test
8. Projection Method

Among the above mentioned methods the projection is the most popular. A brief description of the other methods

fore we make a detailed description of this specific method, would be quite in keeping with the context.

1. Case History Method—In the case history method, as the name obviously indicates, the facts concerning the life of the subject are collected. This case history supplies all the large and small facts related to his environment and heredity. This method can study both normal and abnormal people's personalities but it needs very experienced examiners.

2. Interview Method—The interview method is the most normal of all the methods for the study of personality. It is the method widely used in the selection of people for government services. In this, the subject and the examiner sit facing each other while the former answers questions asked by the latter. Besides the answers which the subject offers, his personality is indicated by his expressions, methods and various other things. This method, like the case history method, needs very experienced examiners who ask questions which can prove the correct thing and which enable the subject to express himself without any apprehension. To tell the truth, interview method depends as much on the examiner as it does on the subject.

3. Questionnaire Method—Questionnaires have been used extensively in the investigation of personality. The name suggests that it is a list of selected questions the answers to which throw light upon the peculiarities of personality. 'Yes' and 'No' are written in front of these questions, the student either strikes out the wrong answer or indicates the correct one. Questionnaires are used to gain knowledge of traits like self-confidence, sociability, introversion or extroversion, tendency to dominate or be dominated etc.

Limitations of the Questionnaire Method

1. Often the subjects conceal the true facts and give wrong answers.

2. Sometimes the framing of the questions is such that the examiner takes them to mean on thing and the subject another.

3. Usually the subjects write the answer without an adequate amount of thinking thus leaving possibility of mistakes.

Use of the Questionnaire Method

Inspite of these difficulties, the questionnaire method has proved to be of tremendous value. Allport and Minnesota etc., have formed questionnaires which enable the study of some subtle

traits of the personality. It affords a lot of assistance to comparative study because of the various answers of the subjects to the same questions. The conclusions based on these questionnaires are comparative as well as numerical, they also facilitate study because a number of people can be studied simultaneously.

4 **Performance Method**—The performance method was conceived by May and Hartshorne. In this method the subject is given a variety of specific jobs to be performed and the subtle quality of his personality examined. For example in order to test the honesty of childern 8 or 10 weights, with little difference between them, were located at some place. The exact weight of each was written under it and the children were told to place them in the order. The honest children experienced great difficulty while the dishonest read the weights under them and placed them in the order promptly. A very simple method of judging the honesty of the students in the class could be something like this. Some piece should be dictated and the copies collected The mistakes of each should be secretly noted without any markings on the copy, following which the copies should be returned with the direction that the mistakes are to be noted and marks allocated. The dictation should be written on the black board. The honest will cancel their mistakes while the dishonest will quietly correct them. The honesty of the students can be judged by comparing these with mistakes previously noted.

5. **Rating Method** : Another method of measuring personality is the rating method, in which roughly the work is done in two ways One, the subject is asked to answer question related to qualities of personality. The answers which the subject offers or the answers which he selects indicate his personality. Another way of applying the rating method is to place the subject in real situations and then study his behaviour and reactions For example, in order to judge qualities like skill, efficiency, labour etc , in a person, he may be given a variety of jobs to perform.

Difficulties in the Rating Method

As it is the rating method is deceptively simple But it needs more skilful examiners. Roughly speaking, it presents the following difficulties :

1. Skill and capability are essential in the examiner.

2. The possibility of prejudice is very great because it is a general truth that no person observes the defects of his near and dear ones.

3. Another grave difficult of this method is the fact that upon observing a particular good or bad quality we class his personality as good or bad and then see good or bad in the other aspects of his personality.

4. It is very difficult to enumerate or evaluate the quantity of one subtle quality. Mistakes are often made in this.

In spite of the above difficulties both social and industrial psychologies make adequate use of this method. As has been pointed out previously too, it can be made realistic to a large extent if the examiner has all the essential qualities.

6. **Situation Test :** As usual, the name suggests the nature of the method. In it, the subject is placed in some specific situations and the qualities of his personality are ascertained. Actually, it resembles the performance method, the difference lying in the fact that in this case the person is placed in a situation while in the performance method he is given some work to do. Most psychologists have identified the two together, rendering a separate discussion indispensable.

7. **Psycho-Analytic Method :** Two types of tests, in the psycho-analytic method of investigation of personality, are more popular viz., Free Association and Dream Analysis. Both these tests show the peculiarities of the psycho-analytic personality in its unconscious aspect. In dream analysis, the subject describes his dream and without using the mind, meaning thereby the unrestricted state of the mind, associates freely the dream objects and activities. Because of the absence of the mental element the truth of the unconscious mind is expressed by this association, by which the psycho-analyst discovers many peculiarities of his character. The psycho-analytic method is mostly utilized in discovering the personality peculiarities, mental traits, and mental ailments of abnormal people. Its main difficulty lies in the need for a skilled and experienced psycho-analyst. Often the psycho-analyst analyses his own mind in order to remove the possibility of any prejudice.

8. **Projective Method :** The most famous and popular of all the methods for the investigation of personality is the projective method. Its name suggests the fact that it is founded upon the

element of projection. Projection means the observation of some specific thing in something or action, according to one's personality and mental state The Taj Mahal, to take an example, is a marble building many people go to see. Different people find in it different things, in keeping with the peculiarities of their personalities. An emotional person sees it in the *form of a formal* symbol of emotions while, to the person who gives importance to political and economic questions, it may be a symbol of exploitation This is an example of a material object but it does make clear the fact that human being does not see an object as it is but also *projects the specialities of his own personality upon it. Many* peculiarities of the personality are investigated by an analysis of this projection and a comparison of it with the projections effected by others.

Tests in the Projective Method

Two tests in the projective methods are more famous—

Rorschach ink blot test, Murray's Thematic Apperception Test, known in brief as T A. T. They are extensively used in the investigation of personality in general. These will, therefore, be described briefly here

1. Rorschach's ink blot test. This test was conceived by the Swiss scientist Hermann Rorschach. He used 10 original ink blot cards which are still in use today. There is no picture made in these blots. Five of these are black, two black and red and the other three *multicoloured*. To investigate personality, they are exhibited before the subject one after the other and he is asked to describe everything he sees in the blot. These are shown for a determined interval of time. These cards are shown to the subject for a second time and he is asked to point out the location, of whatever *he had seen, on the blot In order to establish the meaning* of the subject's reaction to the blots, the psychologist analyses the location, deciding factors and the object The analysis of the location serves to indicate whether the subject reacted to some particular spot on the blot or towards the blot as a whole As a *general rule, it is believed that the person who reacts more completely is more principled* The analysis of the deciding factor is an attempt to find out whether the reaction of the subject is towards the shape of the blot or the colour in the blot or to the motion of the blot As to the object, the analysis shows whether the subject sees in it the figure of a man or of an *animal or of anything else*

Besides the above analysis, facts like the time taken by the subject to react to the whole blot, the number of activities which he did and whether he did them normally or not, are also noted and observed. All these things tend to help in the analysis and investigation of the conceived and unconscious peculiarities of subject.

The biggest difficulty in the ink blot test is that the description of the subject's reactions becomes quite subjective, which conceals to some extent the correct personality peculiarities of the subject. But maximum efforts are being made to make this test scientific.

2. *Murray's Thematic Apperception Test* :—The founder of this test, Murray investigated the pecularities of personality with the help of some pictures. These pictures are still considered to be conclusive. Observing these pictuies, the subject by projection, identifies himself with the characters in the picture. The pictures are presented one by one to the subject who has to compose a story on them in some fixed time period. say five minutes. Unknowingly, the subject expresses many of the perculiarities of his personality in this story by projection. He does not get the time to think. Therefore the story expresses his natural desires, emotions, sentiments etc. On the basis of these stories, the psychologist analyses the personality of the subject and uncovers its specialities.

As in the Rorschach's ink blot test, there is a lot of complexity in Murray's thematic apperception test, and the personality investigation done by it is not numerical but qualitative with grave possibility of mistakes. But, still, there is no doubt that an experienced and skillful psychologist can use this method to uncover the specialities of the personality of the subject. This test helps in the discovery of many mental distortions, enabling subsequently their cure.

21
Work and Fatigue

Q 92 What is work ? Explain muscular work and mental work.

What is work ?

Work can be defined as an action performed with the object of achieving some particular objective. Hence work is an action with a particular aim which is fulfilled by the action. Human beings do various kinds of work to earn their livelihood. Apart from the earning of livelihood actions may have some other objectives such as study, earning prestige, etc. Here it may be objected that play also has an objective and for that reason it would be difficult to distinguish play from work. But two things must be kept in mind. In the first place the player does get some satisfaction of his physical and psychological needs, but he does not start by considering this satisfaction as his goal. In the second place, it is not possible to draw a dividing line between play and work. The same activity may be a game for one individual and work for another, depending upon the attitude. For example, just as the player devotes his entire attention to playing the game without being overtly conscious of the results, the determined worker may perform some activity with complete concentration and be oblivious to the actual results. On the other hand, every player does think in terms of winning and losing, irrespective of how much sporting spirit he has. Hence, while the definition of work given above shows its relative difference from work, it does not indicate that there is a complete difference between the two. As far as the pleasurable and interesting aspect of play is concerned, the same can be and is many times true of work also. The secret of the success of many great people lies in the fact that they found as great pleasure in doing work as they did in play.

Kinds of Work

Work is broadly divided into two categories—muscular w[illegible] and mental work. Before going on to a detailed descript[illegible] these two kinds it is necessary to remember that the two [illegible]

intimately connected with each other that the distinction between the two is merely verbal and a matter of practical expediency. Muscular work requires physical energy. On the other hand mental work requires the expenditure of nervous energy but there is no physical work which does not require some mental participation just as much as there is no mental work which does not consume some physical energy. Hence both kinds of work are mutually dependent, not mutually exclusive.

MUSCULAR WORK

Every human being performs a multitude of muscular actions every day in his life. Muscular work, depending upon the difficulty involved, results in more or less fatigue, sooner or later and one then arrives at a stage when one stops work due to fatigue. This limit differs from individual to individual and from work to work.

Measurement of Fatigue in Muscular Work

The fatigue which is consequent upon all muscular work is measured by the ergograph, an instrument which measures the contraction of the muscles. Although many kinds of ergographs are in use, the most commonly used are Mosso's and Kraeplin's ergographs. In using the ergograph the right or the left arm of the subject is tied in such a way that he can move only the middle finger. Before starting the experiment the instrument for measuring rhythm is fixed at 60°. Then the subject pulls the thread fixed to the ergograph at the first beat of the metronome and relaxes it at the second beat. The contraction and expansion of the muscles in the middle finger are recorded on a sheet of smoked paper through a needle. Since this work of pulling and relaxing the string is continued over a long period and since the string is loaded with some weight the subject's finger becomes fatigued until a stage is reached when the finger cannot pull the thread at all. As fatigue increases, the height of the marking on the smoked paper begins to fall and at the time of total fatigue the markings take the form of a straight line. In this manner the ergograph helps in the study of the effects of fatigue on muscular work.

Effect of Rest on Muscular Fatigue

Muscular work leads to the exhaustion of the muscles and if the muscles are allowed to rest at this time, the fatigue is reduced. It may even be completely eliminated. Many experiments have been conducted to observe the effect of rest on muscular fatigue. Many

important facts about the length and the frequency of the rest period have thus been discovered. For example, in one experiment the subject was given a six kilogramme weight to lift. Lifting of the weight caused muscular contraction and putting it down led to relaxation of the muscles. The subject was given a ten second rest after every lifting. As a result the subject continued to lift the weight at ten second intervals for an indefinite period. After sometime, in a second experiment, the rest interval was reduced from ten seconds to only two seconds and it was found that within one minute the subject became so tired that he could not lift the weight at all. Besides, he had to rest for two hours to get rid of the fatigue accumulated in that one minute of work. It is, therefore, evident from this that it is not only the rest given which is effective in removing fatigue. The rest interval must be given with the right frequency and it must be in proportion to the time spent in work.

Influence of Mental Factors on Muscular Work

The extent of fatigue and time in which it occurs also depend to a great extent upon mental factors. It has been seen that if the individual takes interest in his work he can produce more work for a long time and still not complain of fatigue. Generally, mental fatigue has an adverse effect on muscular activity, although there are many exceptions to this. Sometimes individuals are seen performing mental work with great skill and application despite mental fatigue. Yet, mental factors do undoubtedly influence muscular work.

Other Factors In Muscular Work

In addition to the above mentioned factors many other factors also effectively influence muscular work. For example, it has been observed that women get tired more quickly than men in doing muscular work. Lombard's studies had a very favourable in[illegible] upon the introduction of rest as well as practice, food and [illegible] drinks. Harley's studies showed that tobacco has [illegible] effect on muscular work.

Study of Muscular Work by the Hand Dynamometer

All the above examples of muscular study [illegible] ergograph. But it is also measured and [illegible] dynamometer. In this instrument the [illegible] the dynamometer and pulls it with [illegible] relaxes it. The meter is fixed at [illegible]

is allowed between two successive acts of pulling the handle. The subject performs this function for one minute and in every case the force exerted by the subject is measured in terms of kilograms. If the subject does not take rest but performs the action continuously he tires rapidly and a diminution in his energy is soon apparent. But if he takes rest at regular intervals then he can continue to do this work for a much longer time since he does not become fatigued so quickly.

Value of the Study of Muscular Work

As has been pointed out earlier, the study of muscular work is valuable from the psychological point of view. It is a matter of common experience that output can be increased if muscular fatigue can be prevented. Therefore many measures are adopted to reduce muscular fatigue in most factories and offices. Generally, the workers are allowed to have one or two rest intervals during the working hours, and the period of rest varies from half an hour to one hour. Arrangements are also made for refreshments. Efforts are also made to make the work interesting. In some organisations music is played to the workers while they are working. Then, normally only men are employed to do muscular work while children and women are allowed to do only light muscular work because they become tired much quicker. Studies are still being conducted to discover ways and means of reducing fatigue. In addition to this bonuses are offered to improve the motivation of the workers. It need hardly be pointed out that the worker's efficiency and skill can be vastly improved by these studies of muscular work.

MENTAL WORK

What is Mental Work ?

Mental work involves the use of mental energy. All individuals are not endowed with the same amount of mental energy and therefore all people cannot be expected to perform the same kind of mental work. One common example of mental work is the work of study. In this kind of work, too, some functions are difficult and hard while others are simple and easy. It is, for example, easier to take notes than to write a book. Hence individuals with varying amounts of mental energy are required to perform these simple and complex tasks. Individual differences in respect of mental energy are seen just as they are present in the case of muscular energy. Besides this, some individuals have exceptional mental capacity for

certain specific kind of tasks but negligible capacity for other tasks. For example, the good teacher is rarely a good writer while the good writer may or may not be a good teacher.

Study of Mental Work

Among the many methods adopted in the study of mental work, the more commonly used are :

1 **Letter elimination method**—As is evident from the name itself, in this method the subject has to eliminate certain words from the list provided. He is made to sit comfortably and then given a list and a pencil with which to eliminate letters. This work can be done for any fixed period, from half an hour to one hour. The subject is informed of the completion of the work a minute or two before it actually ends. At the end of the test the subject's personal examination is also recorded Now the letters cancelled by him, the letters left untouched and the letters cancelled incorrectly are counted and an evaluation of his work is made. From this one can evaluate the mental efficiency of the subject.

2. **By addition or subtraction**—In this, the subject is required to do some addition and subtraction and his work and its quality is evaluated on the basis of the right and wrong answers produced by him.

WORK CURVE

Work curve, as is evident from the term itself, is that line upon a graph which indicates the work done by an individual Work curves can be prepared both for mental work and muscular work The work curve of an individual's performance possesses the following three features ,

1. **Initial spurt**—Whenever an individual begins to do some work, he sits down to it fresh and for that reason his production progresses rapidly in the initial stages of the work Hence the work curve progresses quickly in the beginning

2 **Plateau**—This initial spurt or rapidity is not maintained for a long time because the individual invariably begins to get exhausted as he continues to work For this reason his progress begins to fall and then stops increasing

3 **Final spurt near the end**—Whenever the indiv[illegible] that his work is coming to an end he puts in a speci[illegible] the end. This also leads to a rise in the work curve [illegible]

spurt lasts for only a short time. In this stage the individual works enthusiastically although he is exhausted.

The above sketch of the nature of the work curve does not indicate the extent and variety of factors that influence production. But it does suggest that the work curve declines due to fatigue. Fatigue is delayed if the worker has practice in his work. On the other hand, fatigue also has a detrimental effect on the habits formed by practice. Sometimes the worker produces as much in a fatigued condition as otherwise but in that case the quality of the work is definitely inferior to his normal production. All these factors are known as the factors which infiuence production of work.

Q. 94. Write short note on Factors influencing production.

FACTORS INFLUENCING PRODUCTION

The factors influencing production have been discovered after many experiments. Some of these factors help production and increase it while others hinder and retard it. Basically, these factors can be divided into the personal and environmental categories. Personal factors are again of two kinds—the mental and the physical.

(*a*) *Personal Factors*—These are the factors which are inherent in the worker himself. Every kind of work is the consequence of the worker's mental and physical application and it needs the use of mental and physical energy. For that reason the personal factors influencing production are psychological as well as physical.

1. **Psychological factors**—This category includes all those factors which are part of the worker's psychology and have some influence upon the work produced by him. The main ones are the following :

(*i*) *Motivation*—Motivation is the most important factor in production because it increases when motivation increases and falls when motivation is reduced to a lower level. Although motivation alone is not enough to increase production when the individual is completely exhausted it does influence production under more normal circumstances. It is of even greater importance when the work is difficult and complex. The truth of the matter is that motivation will have great influence upon production when the work is more difficult.

(*ii*) *Incitement*—Many experiments have established that production can be increased by incitement. It is difficult to be skilled

in one's work if this is lacking. Its influence is not very apparent in work which is done continuously but it can be seen in all work *which is done at intervals.* This fact has been established by the experiments of Robinson and Hazen. For this reason the workers are given incitement in different professions so that they may produce more.

(iii) *Interest*—It is a commonly accepted fact that production increases if there is interest and decreases if there is not. Interest helps to delay fatigue and also to reduce it. Many experiments have shown that interest is the cause of application and dedication to a task and this increases production.

(iv) *Reward and punishment*—The consequences of an individual's work *influence his production. If the result is reward he* tends to return to his work with even greater enthusiasm. The reward may be material, as in the case of money, or verbal, as in the case of praise, etc. Different individuals react differently to various kinds of rewards but it has some effect, more or less. But the more effective reward is one which is *neither too easily available* nor impossible to attain. It also should not be so cheap as to have *no real value and neither should it be so valuable that the worker* may show greed for it. The effect of reward and punishment can be seen clearly in the case of students. It has very great importance for games.

(v) *Coordination* In any industry the production achieved by a worker depends upon his coordination with the work. It has been seen in the experiments of Kraeplin that in the absence of *coordination there is much greater distraction of attention.* When their coordination improves the loss of attention is considerably less with the result that they can concentrate on their work and produce more.

(vi) *Establishing rapport between the workers.* If many workers are to work simultaneously to complete some work then rapport must be established between them. Besides, production is better also when the relations between *the workers are friendly and* cordial. On the other hand, absence of such relations leads to loss of production in terms of quantity as well as quality.

(vii) *Blocking*—*The* effect of blocking on production can be seen in the experiments conducted by Bills. According to him, a person can perform some mental work continuously. In certain cases the frequency of blocking is as high as four or five times with

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(b) Environmental Factors

The environmental factors influencing production include all those circumstances and conditions which alter production in any ways. The more important ones are the following :

1. **Light**—In every kind of industry some degree of light is necessary. But if the intensity of the light is more or less than required then production suffers. The quality of light, in addition to its quantity, also affects production. The best light is the natural light of the sun. It not only helps vision but also has a good effect on the health but in its absence white light is believed to be the best substitute. In addition to the quantity and quality the distribution of the light available is another effective factor. The light should be so distributed over the working area that it should light up and illuminate the machines and other instruments being used by the workers. But it should not fall directly upon the eyes of any workers because this may dazzle him and lead to accidents. If the light is adequate it will avoid straining the eyes and in this manner contribute to the skill of the worker.

2. **Ventilation**. If many people work together on the same premises it becomes necessary to make provisions for the flow of clean air into the place and of stale air out of the place. Besides, in many kinds of work many harmful gases are generated in the process of production. It is essential that such gases must be ejected as rapidly as possible. All kinds of experiments have indicated that proper ventilation has a positive effect on production and the absence of such arrangements leads to the ill health of the workers and a subsequent fall in production.

3. **Temperature**—In many offices and factories it becomes necessary to control the room temperature in the premises in order to maintain the efficiency of the staff because excessive heat or excessive cold have an adverse effect on production. The proper temperature can be determined only by the nature of the work, the local climate, the location of the factory and also by the average health of the workers. But it can be said definitely that it is necessary to maintain proper temperature for good production. For this reason many laboratories are air-conditioned nowadays.

4. **Noise**—Some experiments conducted upon the effect that noise has upon production indicated definitely that when it ... above a certain pitch it is definitely harmful. The pitch

that can be tolerated depends upon the habits of the worker, his skill and the nature of the work. Many experiments have been conducted in this connection and many means devised to reduce the volume of noise in factories. Many modern laboratories are sound-proofed to external noise so that the workers within are not disturbed.

In this account of the factors influencing production, only the more prominent personal and environmental factors have been taken into account. In actual fact it is not possible to list the total number of factors Besides, psychologists attached to different industries continue to study these factors and make experiments. They help in revealing many new facts

5. **Rest Pauses**--It has been found that adequately timed rest pauses of proper duration have a positive influence upon production. It is possible to determine by experiment the length and frequency of the rest pause which will be adequate for a particular individual. Vernon and Bedford conducted an experiment on 17 young girls in which the girls were given a rest of ten minutes after every hour of work. A twenty per cent increase in production was observed. In another experiment in which seven girls were involved a thirteen per cent increase in production was noticed when they were allowed to rest after every hour. In an experiment by Ermaski it was seen that when a five minutes interval was introduced after every hour of work and a fifteen minute interval after every hour and quarter of work, twenty five per cent improvement in production was noticed. Graff conducted some experiments and concluded that production is increased if a rest of two minutes is given after forty minutes of mental work and a rest of five minutes after eighty minutes of mental work. On the basis of experiments it was found that a rest pause of 6 to 10 minutes after every two hours of work proves useful and beneficial in the case of middle aged workers Some other experiments have shown that if the rest pause is more or less than a particular limit then it will hinder production instead of helping it. If the rest pause is too long it is harmful because the worker's enthusiasm cools down and it amounts to beginning a fresh. Besides it also leads to boredom and disgust. In an experiment by Amberg a rest pause of 5 minutes was found useful while a rest pause of 15 minutes proved definitely detrimental In the same way different lengths and varying frequencies of rest pauses can be determined for different persons. The basic fact is that the rest pause should

be long enough to eliminate fatigue and make the worker fresh but it should not be so long that it may induce boredom, lethargy and disinterest. It is only natural that different rest intervals will be required for individuals with varying personal interests, capabilities, abilities, etc. Hence it is the worker who himself can tell how much rest he requires and after what interval of time. The basic principle governing the timing of the rest pause is that it should be introduced after the period of maximum production because soon after this production begins to fall. If rest is provided at this time, this inevitable fall in production can be eliminated.

6. Group situation—Psychologists have conducted many experiments to find out whether production improves while working in a group or if it is better when the individual is working alone. Modi induced a group of youngsters to do muscular work on the hand dynamometer first individually and then in pairs, and came to the conclusion that production was two percent more in the group situation than while it was done alone. In his experiments on college students, Whitmore saw that production was twentysix per cent more when work was performed in a group situation. The main reason for this increase in production in the group situation is that a definite competitive spirit comes into play while working together. As a result the individual worker is induced to bring into work his entire energies. But this kind of increase in production is mainly quantitative because in terms of quality the work generally deteriorates. The reason for this phenomenon is that the worker is constantly interested in the total work done by others and in trying to do better than them fails to consider the quality of his own work. Although generally the more skillful individuals retain their skill while working collectively, some individuals are found to perform better while working alone. This fact depends on the one side upon the individual nature and working habits of the person, and on the other side upon the nature of work. For example mental work in which quality counts, the creation of art or literature, is better done alone because in a group situation there is too much distraction of attention. But this fact cannot be said to be true of all writers and artists, because much depends upon the working habits of each individual. On the other hand mechanical, physical and work in which quantity alone is important, are normally better performed collectively.

Q. 95. What do you understand by Fatigue? State describe the various kinds of Fatigue. (Agra 19??, ???)

6. *Change in Emotions* : Another factor which introduces fatigue is an unrelenting application to work and a consistent, hard, and laborious way of life. Thus a change of emotions once in a while will also reduce fatigue.

These factors which eliminate fatigue generally apply to everyone but a person may pick and choose according to his own interests. There may be other factors especially suited to persons with particular tastes, inclinations and interests.

Types of Fatigue

There are four types of fatigue—mental, physical, nervous and boredom. The following are the respective signs of these four types of fatigue—

1. *Mental fatigue* : The following are the signs of mental fatigue—

(i) Difficulty in focussing attention.
(ii) Reduction in interest in physical work.
(iii) Fall in respiration rate and temperature.
(iv) Heaviness and headache.
(v) Lack of physical equilibrium.
(vi) Decline in the power of discrimination and determination.
(vii) Restlessness and irritability. Non-acceptance of suggestions.

2. *Physical Fatigue* : The following are the signs of physical fatigue—

(i) Increase in blood circulation.
(ii) Quick and difficult breathing.
(iii) Increase in the body temperature.
(iv) Inability to do mental work.
(v) Pain in some parts of the body.

3. *Nervous Fatigue* : The following conditions indicate nervous fatigue—

(i) Abnormal behaviour.
(ii) Fatigue without work.
(iii) Inactivity, sluggishness, restlessness.
(iv) Lack of fatigue even after hours of working.

4. *Boredom* : The following conditions are indicative of boredom—

(i) Restlessness.
(ii) Absence of opportunity to express the desire for saying or doing something.